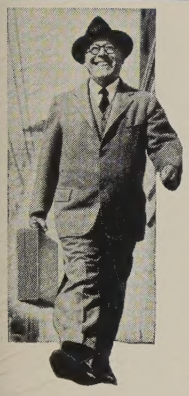
This Week in STEEL The Metalworking Weekly

January 5, 1959
Vol. 144 No. 1



The Changing Role of Metalworking Managers

Here is an article that will give you something to think about as metalworking enters a new year.

It is important to you as a manager because your role is changing as all America is changing. Of the many ways your job and responsibilities have shifted over the years, six stand out:

- You're a professional.
- You're a communicator.
- You seek new knowledge.
- You have wider knowledge.
- You're a pioneer.
- You're on guard.

Other special features in STEEL's Metalworking Yearbook issue include results of a survey of plant managers on what to expect in 1959; the Washington and Detroit outlooks; a 48-page Facts & Figures section; a forum on technical progress covering 15 categories; and a chronology of 1958.

WHERE TO FIND—

STEEL, the metalworking weekly, is selectively distributed without charge to qualified management personnel with administrative, production, engineering, or purchasing functions in U. S. metalworking plants employing 20 or more. Those unable to qualify, or those wishing home delivered copies, may purchase copies at these rates; U. S. and possessions and Canada, $10 a year; all other countries, $20 a year; single copies, 50 cents. Metalworking Yearbook issue, $2. Published every Monday and copyright 1959 by The Penton Publishing Co., Penton Bldg., Cleveland 13, Ohio. Accepted as controlled circulation publication at Cleveland, Ohio.

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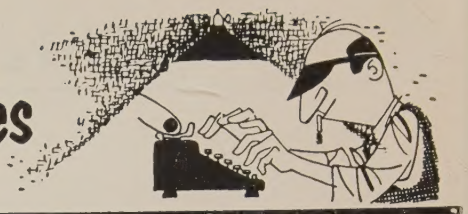
behind the scenes



Wherein Mr. Shrdlu Orbits 8 to the Bar

Observe, good friends, this mighty tome
From which you'll be inclined to comb
A wealth of facts, and figures, too,
As joyously you hurry through!
The information printed here
Is cogent, potent, and sincere—
But then, it simply MUST be, when
It's aimed at metalworking men.
The cover with its neat design
(Including nineteen fifty nine
Spread south to north, to say the least,
Instead of reading west to east)
Points out the things you ought to read
If lack of time your course impedes.
A story that will eftsoon goad
Executives who erst abode
In settled, tacit, firm belief
Their roles were changeless—well, in brief
This story gently spills the beans
About executive routines;
You see, through twenty years, and wars,
Big changes swept this gifted corps.
The expectations subsequent
Of metalworking management
Concerning business hopes and fears
Are out of—shall we say?—this sphere.
You'll like their cheerful estimate
That 'fifty nine beats 'fifty eight.
(We hope these cats are right-ho, Fred,
'Cause if they ain't, us ducks are dead!)
Your deep attention won't be lost
On items such as price and cost,
Or how to quickly fabricate,
Not by methods antiquate,
But by the aid of modern tricks
Evolved through business politics—
Through research labs, and boardrooms, too,
Where progress is the thing they woo.
No wonder that we recommend
This tome on which the world depends
The metalworking world, we mean—
But mercy, let's not stand between
The reader and this mighty book
For fear he'll label us a schnook;
So on behalf of STEEL *we'll rear*
And wish you all a Glad New Year.

1468
9-25-59

Shrdlu

(Metalworking Outlook—Page 87)

Cincinnati Hydroform · Hydrospin

make the nose sections flow for TAPCO GROUP of *Thompson Ramo Wooldridge Inc.*

Tapco Group, contractor to supply nose sections for the highly accurate, air-to-surface "Bullpup" missile, employs Hydroforming and Hydrospinning to form these parts at high production rates.

Photo at left shows preforms being produced with minimum thinout, on a Cincinnati 32″ Hydroform®, at rate of 90 per hour. Preform is of 6061 Aluminum, 14″ major diameter x 13″ deep x ⅛″ wall thickness. Preforming is a sub-contract operation by Jones Metal Products Co., West Lafayette, Ohio.

The preform is heat-treated, then "*chipless machined*" on the two-roller Cincinnati Hydrospin® in two operations (bottom photo). First spinning roll-flows the preform to 20″ length x 12″ major diameter x 0.080″ wall thickness, in 3½ minutes. Final spinning increases part length to 40″ and reduces wall thickness to 0.040″. Floor-to-floor time, 4¼ minutes.

For your missile metalworking, you'll save time and money by teaming-up with Cincinnati Hydroform and Hydrospin machines. Call in a Meta-Dynamics Division field engineer for detailed information.

Hydroform/Hydrospin

META-DYNAMICS DIVISION

Machines for Metal Forming and Heat Treating

THE CINCINNATI MILLING MACHINE CO.
Cincinnati 9, Ohio, U.S.A.

CINCINNATI

LETTERS
TO THE EDITORS

Praises Renegotiation Series

We read the series of renegotiation articles (Nov. 24, p. 62; Dec. 1, p. 42; Dec. 8, p. 64) with interest.

It is the consensus that STEEL's presentation of this vexing problem is the most informative and comprehensive yet written. Congratulations!

Joe Rogers
National Security Industrial Association
Washington

1959: No Pushover

We think your editorial, "1959: No Pushover" (Dec. 8, p. 61), is extremely good, and we would like permission to reproduce it for mailing to our salesmen and customers.

C. E. Drake
President
Drake Corp.
St. Louis

• *Permission granted.*

Good Fortune

Recently I had the good fortune to hear of "To Boost Productivity Consult Your Employees" (Sept. 29, p. 65). Will you send me five copies?

M. L. Moore
Industrial Relations Dept.
National Lead Co.
New York

Reader Looks Forward to STEEL

May we have a copy of "Construction Tool Slashes Furnace Maintenance Costs" (Dec. 8, p. 116)?

We look forward to each issue of your fine magazine and always find something in it of real interest to us.

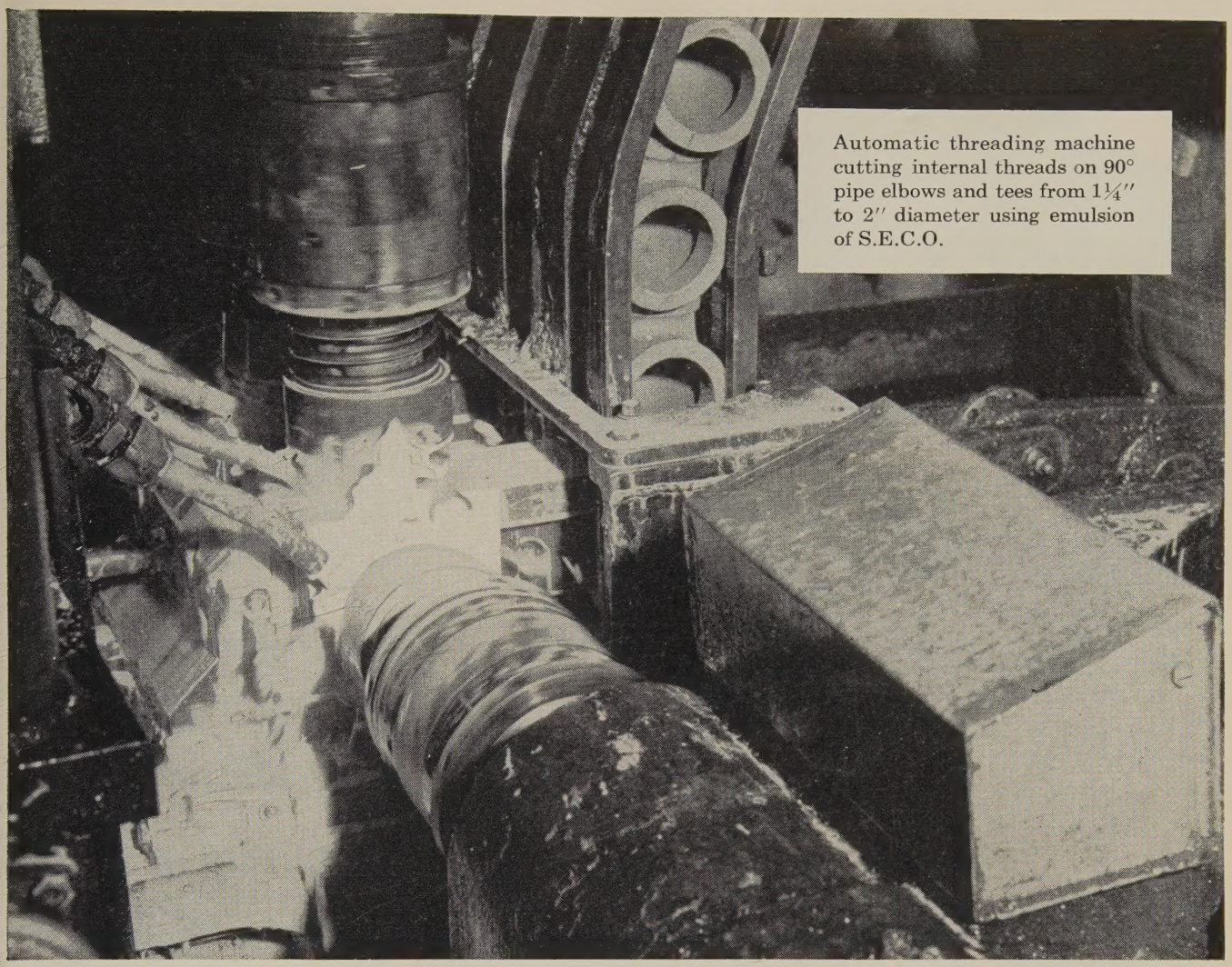
Donald L. French
Structural Metals Inc.
Seguin, Tex.

Corrosion: A Constant Problem

We are interested in obtaining the source from which one of the Technical Outlook items, "Films Indicate Corrosion" (Nov. 10, p. 117), was written.

Corrosion with its resulting wear is our

(Please turn to Page 12)



Automatic threading machine cutting internal threads on 90° pipe elbows and tees from 1¼" to 2" diameter using emulsion of S.E.C.O.

Photo courtesy of Grinnell Corporation

NEW S.E.C.O. EMULSIONS, WITH SMALLER OIL-PARTICLE SIZE, CUT PRODUCTION COSTS

There's a new and greatly improved S.E.C.O. (Sunoco® Emulsifying Cutting Oil), that has smaller emulsion-particle size to give you the following benefits:

- BETTER PROTECTION AGAINST RUST, even at emulsion ratios as lean as 40-to-1.
- BETTER DETERGENCY, which permits dirt and fines to settle quickly out of emulsions, leaving machines clean.
- BETTER EMULSION STABILITY. Even in hard-water areas, emulsions of *new* S.E.C.O. stand up better than those made with other regular emulsifying cutting oils.
- BETTER FINISHES, CLOSER TOLERANCES. New S.E.C.O., with better coverage and wetting of work, produces consistently finer finishes in machining. Reject rate falls off. Tool life increases.

TRY *NEW* S.E.C.O.—for increased economy in all machining operations. Ask your Sun representative, or write to Department S-1.

Industrial Products Department

SUN OIL COMPANY, Phila. 3, Pa.

SUNOCO

In Canada: Sun Oil Company Limited, Toronto and Montreal

LETTERS

(Concluded from Page 10)

greatest difficulty, and we are constantly seeking new ideas and approaches to the problem.

Congratulations on a useful and informative publication.

E. A. Burkhardt

Link-Belt Co.
Indianapolis

• *Send $2.25 for PB 131894 to Office of Technical Services, Department of Commerce, Washington 25, D. C.*

Enjoys STEEL's Facts

May we have two additional copies of STEEL each week? I certainly enjoy the magazine and its pertinent facts about the steel industry.

Dennis J. Scherrer

Star Pump & Cooler Corp.
St. Louis

Wrong Photo but Good Process

The machine you pictured in "Cold Extrusion Saves Metal" (Nov. 17, p. 112) was not a press as stated in the caption, but a Conomatic lathe.

We are quite interested in this process and would like more information regarding it.

W. E. Pierson

Manager of Purchases
Caterpillar Tractor Co. Ltd.
Glasgow, Scotland

• *We regret the inaccuracy. For information we suggest you write the manufacturer of the press, Danly Machine Specialties Inc., 2107 S. Laramie Ave., Chicago 50, Ill.*

Sympathy for Sheldon Schmaltz

I read with interest "The Revolt of Sheldon Schmaltz" (Nov. 24, p. 68).

After putting on trade shows for 31 years, I am sure that others feel the same way as Sheldon Schmaltz. May I have an extra copy of the article?

L. J. Lieberman

Product Manager
Algrip Sales
Alan Wood Steel Co.
Conshohocken, Pa.

• • •

We would like to send this worthwhile article to our representative in the field. Will you send us 75 reprints?

Harold S. Mercier

General Sales Manager
Tool Steel Gear & Pinion Co.
Cincinnati

Shows Interest in Opportunity

We have read "Wanted: A Revolution in Manufacturing" (Nov. 24, p. 100) with interest. May we have a reprint?

W. H. Hain

Foundry Sales Administrator
Metals Processing Div.
Curtiss-Wright Corp.
Buffalo

Stage Set for '59 Industrial Shows

Two shows will open the 1959 industrial exposition season Jan. 26.

The tenth annual Plant Maintenance & Engineering Show will be held in Cleveland's Public Auditorium Jan. 26-29. Clapp & Poliak Inc., New York, will manage it and the Plant Maintenance & Engineering conference, a concurrent event.

Philadelphia's Convention Hall will be the scene of the International Heating & Air Conditioning Exposition, Jan. 26-29. Society of Heating & Air Conditioning Engineers is the sponsor. International Exposition Co., New York, will manage the show.

The 11th biennial Western Metal Exposition and Congress will be held Mar. 16-20 in Pan-Pacific Auditorium, Los Angeles. American Society for Metals is the sponsor.

"For Mankind's Progress" is the theme of the 1959 Nuclear Congress, Apr. 5-9, at Cleveland's Public Auditorium. Atomfair, an exposition at which manufacturers of equipment used in the nuclear field will display their latest developments, will be staged at the same time. Engineers Joint Council is the co-ordinator of the event.

The American Welding Society's Welding Show will be at the International Amphitheatre, Chicago, Apr. 7-9.

The Design Engineering Show & Conference is scheduled for May 25-28 at Convention Hall, Philadelphia. Clapp & Poliak will manage the show.

On June 9 the Material Handling Institute's national exposition of material handling equipment will be staged at Cleveland's Public Auditorium.

Chicago will be host to two major shows this fall. The first will be the International Instrument-Automation conference and exhibit, Sept. 21-25. The Instrument Society of America will sponsor the show. On Nov. 2-6, the American Society for Metals annual National Metal Exposition & Congress will move on the scene. Both shows will be at the International Amphitheatre.

For other major meetings and exhibits in 1959, see Page 401.

Tuffy® Tips On **SAFE USE OF SLINGS AND HOIST LINES**

Lifting Strains Take High Toll of Injuries

Did you know that in some states one in every six compensation claims involves back injuries? And that one insurance company says back injuries constitute 60% of their claim expense?

Hernia is another hazard of materials handling. One manufacturer reported 75% of his compensation claims involved hernias. This high incidence of hernias and back injuries can be greatly reduced by proper lifting equipment and methods.

What can you do to reduce materials handling accidents? Here are some of the answers:

1. Teach your workers rated load factors. Warn them not to overload slings.

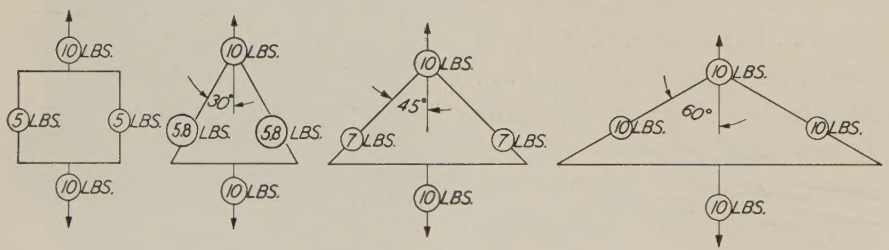
2. Use the right size hoist for every heavy lifting job. Don't put the load on human muscle.

3. Show workers how to rig hoists properly and safely. Load chains shouldn't be used as slings. Previous distortion and weakening of links may cause them to break even with a light load.

4. Inspect hoist load brakes often. Slipping or dragging brakes should never be used.

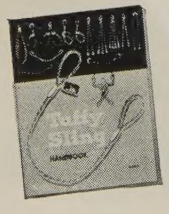
5. Be sure to use the proper sling for the job. Don't assume that all slings made of wire rope are right for all lifting operations.

How Sling-Leg Load Increases with Increased Fleet Angle



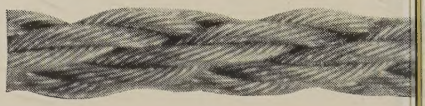
These four drawings show approximate load increases on each leg of a bridle sling as the vertical angle of spread between legs increases. For accurate factors for the various angles, refer to your Tuffy Sling Handbook. (Don't have one? Write Union Wire Rope Corporation. Specialists in high carbon wire, wire rope, braided wire fabric and stress relieved wire and strand. 2160 Manchester Avenue, Kansas City 26, Missouri.)

Get Your FREE Tuffy Sling Handbook

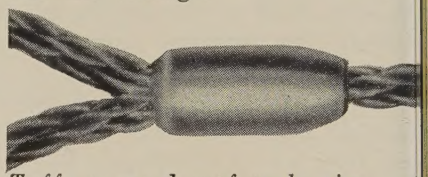


Gives full data on Tuffy Slings. Types, dimensions, weights and rated loads. Also contains an expanded section on fittings — many not previously shown. Write for your copy now.

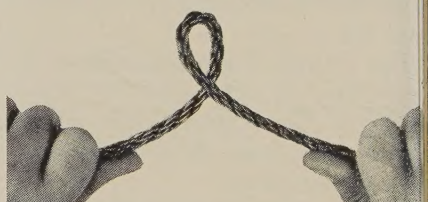
Why Tuffy Slings Do A Bett Job More Safely



Tuffy Slings have a combination extra strength and super flexibili The patented machine-braided fab is the secret. It gives Tuffy great strength, faster handling, longer li greater safety than ordinary slings at a cost to service life ratio that fi ures low. And it's so flexible th kinks can be pounded out witho material damage.



Tuffy pressed-on ferrule gives ey splice full fabric strength. The ste ferrule is applied under tremendo pressure. It literally flows into spac between wires and strands. The fri tion force thus created gives the ey splice 100% of the fabric strengt And the streamlined Tuffy ferru leaves no openings or rough proje tions to snag or injure hands.



Tie a knot in a Tuffy Sling? Pull as tight as you can. Even if you kin it, it's still easy to straighten o with no material damage to the slin

See Your Tuffy Distributor

He's stocked for fast delivery of all yo Tuffy Slings and Union Wire Rope need

UNION Wire Rope

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Metalworking Outlook

January 5, 1959

GNP, Industrial Output To Jump in 1959

Look for a gross national product of $470 billion in 1959, compared with $436 billion in 1958. We'll experience an annual rate of $462 billion this quarter—$472 billion in the second period, $471 billion in the third three months, and $475 billion in the fourth. Discounting the seasonal slip in July, August, and September, we'll find 1959 a year of steady gains. The Federal Reserve Board's industrial production index should average 147, compared with 134 for 1958. Next December should see the high point at 152. More and more emphasis will go on sales, particularly selling on a technical basis, in the next 12 months (Page 189). Result: Your volume should be up 8 to 10 per cent, on the average.

Your Income To Rise; Prices Fairly Steady

Your personal income should rise again in the coming year; the nation's total will be $373 billion. That compares with $353.5 billion in 1958, a record high despite the recession. Our bulging income is one of the big reasons why the 1957-58 recession was no worse than it was and why we're pulling out of it so rapidly. Prices should be fairly steady in 1959, too—up about 2 per cent for industrial products, but up less than a percentage point generally because of lower food costs. No sensational consumer spending spree is in the offing. Your expenditures will still be fairly high, but not as in 1954-55 when they were a major contribution to our recovery. U. S. manipulation of credit rules is likely to encourage stability in personal outlays.

The Changing Role of Metalworking Managers

The 1959 expectations for personal income will be 410 per cent above the $72.9 billion that jingled in Americans' jeans in 1939. That's just one of many reminders of the big change this country has undergone the last score of years. To you managers that shift has brought new problems—and new opportunities. Managers in the middle levels, particularly, are more numerous, better trained, more needed to solve questions of productivity, marketing, cost control, labor relations, and profitability (Page 95).

Profits To Climb, But Not Enough

Total corporate profits before taxes will rise in the next 12 months. Watch them hit $46 billion. That compares with only $36 billion in 1958, and $43.5 billion in 1957. Despite the improvement, they'll still be inadequate as

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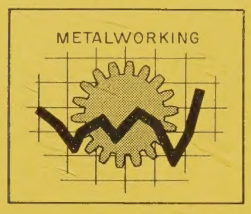
Market Outlook—Page 439

metalworking continues to battle profit erosions from rising labor and other costs, a tight lid on many prices, and inadequate depreciation allowances.

Facts and Figures of the World's Largest Industry



The government's antiquated policies on depreciation are a factor that will keep new plant and equipment spending at disappointing levels in 1959. Expenditures should total $32 billion for the year, up from the so-so $30.5 billion of 1958. As STEEL's records of capital spending show (opposite Page 138), we need sharply increased outlays to have what you can call a boom. One is not in the offing this year.

Peak Employment by March or April

Watch for us to catch up with the 1957 peak employment of 67 million by March or April. But because of the larger labor force, our unemployment will be a little higher and probably won't simmer down to 3 million until the fourth quarter.

Sharpest, Shortest Postwar Recession Is Over

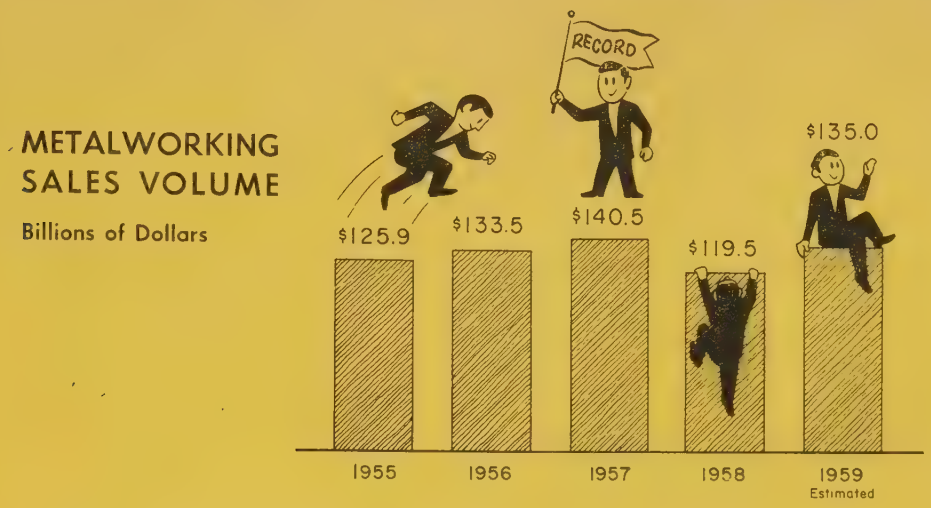
Defense cutbacks of about 50 per cent in mid-1957 probably triggered the 1957-58 recession. Capital spending, steel production, and other key activities were leveling off or going down at that time, and the defense move was the fuse. Of our three recessions since the end of World War II, this one just ending has been the sharpest but the shortest.

Congress Will Spend 7% More

Your Congress this year will be in a spending mood—for defense, to help depressed domestic areas or depressed industries. But it will be kept in tight rein by leaders like Sen. Lyndon Johnson (D., Tex.) who don't want the deficit to go much higher than the whopping $12 billion estimated for fiscal 1959. The Democrats in Congress want some credit for thrift that will be remembered in the Presidential voting of 1960. The result will be that the forces for spending will win out this year—but by a narrow margin. Look for federal spending to rise about 7 per cent in calendar 1959 over 1958. Much of this will be for hard goods or to otherwise help metalworking (Page 108).

What Metalworking Managers Expect

Managers responding to our annual survey tell us that metalworking sales may climb to $135 billion in 1959, much better than last year's performance but still below 1957 (Page 99). Steel production this year will reach 110 million ingot tons, vs. 85 million in 1958. We'll turn it out this way: 27



million tons in the first quarter, 29 million in the second, 24.2 million in the third, and 29.8 million in the fourth. Strike possibilities look ominous, which is why the third quarter may be down so far. Last year was a time of drastic steel inventory liquidations. Now we're starting on the accumulating side of the cycle, speeded both by better business among steel users and by the fear of a strike. Steel stocks are now estimated at about 14 million tons, up 1 million from the low point of last August. By next July 1 (when the current steel labor contract expires), they may reach 19 million tons.

Industry-by-Industry Prospects

Steel consuming industries should fare about this way:

✔ CONSTRUCTION . . .

This hardy perennial, a pace setter ever since World War II, will continue its sky-high ways with a record $53 billion year in 1959. That compares with $49.5 billion in 1958. The highway program is finally shifting to overdrive but could stall if Congress can't decide on how to finance it. However, look for an early solution there. Not so promising is industrial construction, which will have a mediocre year at best. Private and public housing starts should number 1.2 million, compared with 1,160,000 in 1958. Public construction, other than roads, will be high, as will institutional and commercial building.

✔ AUTOMOBILES . . .

At this early point in the 1959 model sales campaign, prospects are still built largely on faith, hope, and charity. If December's good sales of about 500,000 hold up, we'll have a 5.8 million car year in calendar 1959. But the conservatives still stick with 5.5 million—a figure that was considered highly optimistic only two months ago. We'll import about 400,000 this year, but General Motors Corp. and Ford Motor Co. will not introduce their economy cars (Page 119) until fall, the normal introduction time for 1960 models. If 1959 sales slump badly, the Big Two would reconsider that decision. GM could probably introduce its line early next summer if it had to. The automotive industry provides a clear illustration of how a steel consumer's inventory policies can affect the steel industry. Last year in a period of sharp stock liquidation, the automotive buyers took 9.5 million tons of steel to build 4,250,000 cars and 870,000 trucks. This year in a period of sharp stock accumulation, they'll take 14.5 million tons if they build 5.8 mil-

lion cars and 1 million trucks. That's about 50 per cent more steel to build 35 per cent more products.

TRANSPORTATION EQUIPMENT...

The boom-and-bust freight car industry is still in the bust cycle. About 40,000 cars will be turned out this year, compared with 42,000 last year and 101,500 in 1957. Railroad maintenance will be up a little . . . U. S. shipyards turned out (including conversions) a record peacetime 1 million dead weight tons in 1958. Nearly 30 million tons are now under construction, including 34 cargo ships and 80 tankers. In 1959, 32 ships will be launched . . . With 80 per cent of the aircraft-missile industry's sales in military products, it sees 1959 sales at well over $10 billion, compared with $11.8 billion in 1958. The missile backlog isn't increasing as rapidly as the aircraft backlog is dropping.

APPLIANCES AND UTENSILS...

Look for a 10 to 15 per cent increase in unit sales here. The industry ended 1958 with a bang. Because of an inventory policy shift similar to that in autos, manufacturers will take far more steel this year than last—about 2.6 million tons, compared with 2.1 million in 1958.

MACHINERY...

A so-so year is ahead for most types of nonelectrical machinery; a downright poor one is the prospect for machine tool builders. Machine tool sales should reach about $455 million this year, compared with $360 million in 1958. That's far less than half the industry's potential. It has capacity to build more than $1 billion worth of machine tools each 12 months.

ELECTRICAL MACHINERY...

The outlook here is better than in nonelectrical machinery. Look for a 7 per cent gain over 1958. Dampening the optimism is the growing competition from foreign builders, selling both in the U. S. and in our export markets. Machine tool manufacturers have the same trouble.

FARM EQUIPMENT...

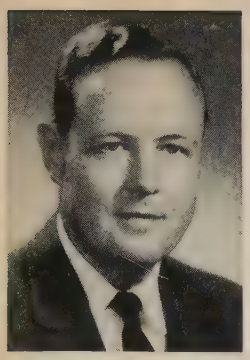
Sales this year will equal or surpass the estimated $2.2 billion harvested in 1958. Last year was the best for farm implement makers since 1951. They were the first to feel this last recession, and they are among the first to plow out of it.

OIL AND GAS EQUIPMENT...

The Supreme Court's reversal of the Memphis decision last month restores the authority of natural gas companies to raise rates without first obtaining the consent of all their customers. Result: Expansion programs will be resumed. Look for 3.4 million tons of pipe to be laid in 1959, vs. 2.6 million in 1958. This year's total won't surpass the 1957 record of 4.2 million tons laid in 1957, but it will be better than the 3.2 million average since 1949. Makers of valves and all the other equipment needed for pipelines expect gains of 15 per cent and more over 1958.

CONTAINERS...

Watch for makers of barrels and drums to boost production 3 per cent in the coming 12 months over output last year. Canmakers will jump 6 per cent in unit volume.



Your Problems in 1959

As the new year gets underway, it is a good time to take a look at the problems which will have some bearing on the primary objective of every business enterprise: Making a profit.

We have the assurance that 1959 will be a good year. Estimated metalworking sales of $135 billion will be up 10 per cent from $120 billion in 1958 and down less than 4 per cent from the record of $140 billion in 1957.

We also have assurance that markets will continue to expand—and at a rate greater than most people anticipated. In 1955, the Census Bureau figured our population would be 221.5 million in 1975. Now it has revised its estimate to 235.2 million.

But despite our growth in population and markets, we will still have a number of problems:

Concentration of union power in an unregulated monopoly so strong it can cripple entire industries and win the election of political candidates.

Continued federal deficit financing as the sputnik war grows hotter.

Increasing burden of state and local taxes and the dim prospects for tax reform at the federal level.

Financing plant expansion as rising wages and price competition put the squeeze on profits and making borrowing and equity financing more difficult.

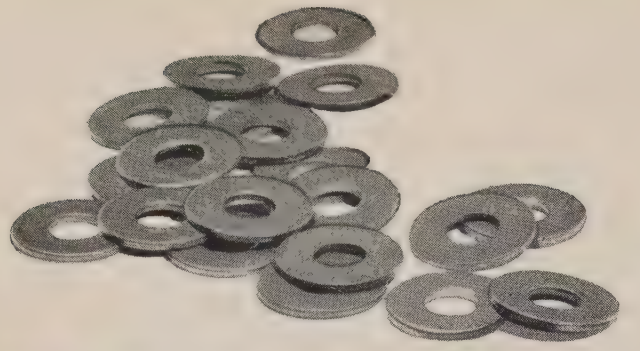
Changing markets and technologies that often render products obsolete and unsalable overnight.

Inflation that has reduced the value of the dollar by one-half in 20 years.

Since the profit motive is the foundation of the free enterprise system, everyone (whether in labor, management, or government) has a stake in finding solutions to those mutual problems.

Irwin H. Such

EDITOR-IN-CHIEF



MILWAUKEE WROT WASHERS

. . . now they're WASHED!

SINCE 1887

Quality-conscious production methods call for modern materials . . . even down to your nut-and-bolt assemblies. Now you can buy Milwaukee WASHED WASHERS to promote cleaner workmanship, cleaner product-assembly, and upgrade the morale of production workers through a thoughtful regard for personal cleanliness.

Today, all popular sizes of Milwaukee U. S. Standard and S.A.E. Washers, Rivet Burrs and Machinery Bushings are *washed* by a special process that removes all oil, graphite or other grime. In addition, this *Milwaukee Wrot Washer washing process includes rust resistant treatment.*

Since the introduction of this improved processing of Milwaukee Wrot Washers, Industry has responded with a most enthusiastic vote of approval. Many production orders *specify* "WASHED WASHERS" . . . but whether you specify "Washed" or not, that's the way they are supplied . . . clean washers for clean workmanship and clean workers . . . to match your highest production standards.

Specify "Milwaukee Wrot Washers" for better Quality Control.

plus . . .

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The Changing Role of Metalworking Managers

IN 1939, 131 million people lived in these United States. In 1959, our population will rise to 176.8 million.

IN 1939, we had a gross national product of $91.1 billion. In 1959, our GNP could reach $470 billion.

IN 1939, the metalworking industry chalked up sales of $17.7 billion. They will hit $135 billion in 1959.

IN 1939, the steel industry produced 52.8 million tons of steel. In 1959, 110 million tons will be turned out.

IN 1939, the average family income was $1850. In 1959, it will be $6400.

The economy has changed as much as the powerplant in your car. Your '59 model has about four times the horsepower of your '39. You could change the sparkplugs and make minor adjustments on the '39 yourself. The '59 challenges the most skilled mechanic.

But the '59 runs with far greater smoothness, acceleration, and power than your '39—provided it is properly tuned. The comparison holds true for our economy.

In 20 years, we have moved from an era of scarcity to one of abundance. But today we need greater skill to keep our economic machine adjusted. Your major role as a manager is to help keep it in tune so that the abundance is divided equitably.

Your role is changing because America is changing. Of the many ways your job and responsibilities have shifted, six stand out:

1. You're a Professional

The growing complexity of the economy necessitates more specialists to run it—more managers, particularly in the middle levels of administration, production, engineering, and purchasing. You in that stratum are the new professionals—as far removed from the old seat-of-the-pants salesman, straw boss, mechanic, or buyer as a doctor is from the barber-surgeon.

Harvard Business School and dozens like it provide your graduate training just as medical schools prepare our doctors. The American Management Association is to the professional manager what the American Medical Association is to the doctor. The Harvard Business School and American Management Association have had their

The Changing Economy . . .

	1939	1959	INCREASE
Population	131 million	177 million	**35%**
Civilian Labor Force	55 million	69 million	**25%**
Total Employment	45.8 million	65.8 million	**43%**
Manufacturing Employment	10.1 million	16.5 million	**63%**
Metalworking Employment	3.3 million	6.9 million	**109%**
Wholesale Price Index (1947-49 = 100)	50.1	121.5	**142%**
Personal Income	$72.9 billion	$373 billion	**410%**
Steel Industry Hourly Wage (min.)	62½¢	$1.96	**213%**
Manufacturing Hourly Earnings (avg)	63-1/3¢	$2.20	**247%**
Family Income (annual avg)	$1,850	$6,400	**245%**
Aluminum Production (tons)	163,545	1.8 million	**1000%**
Copper Production (tons)	712, 675	1.2 million	**68%**
Steel Capacity (tons)	81.8 million	146.5 million	**79%**
Steel Production (tons)	52.8 million	110 million	**108%**
Gross National Product	$91 billion	$470 billion	**416%**
Metalworking Sales	$18 billion	$135 billion	**650%**
Capital Goods Expenditures	$5.5 billion	$32.8 billion	**496%**
Passenger Car Output	2.9 million	5.5 million	**89%**

great growths since 1939. The professional manager has arrived.

2. You're a Communicator

Consider the case of Thompson Ramo Wooldridge Inc. It started life as a maker of automotive parts. It still makes them, but now it's also in aircraft, electronic hardware, and space age technology. It started out being managed from Cleveland. Now its chairman operates primarily out of that city, but its president is headquartered 2000 miles away in Los Angeles.

While distance makes communicating more difficult than it was in 1939, just plain growth has added most to your problems as a communicator. Thompson had 3900 employees and sales of $16 million in 1939. Today, it has 20,000 workers, and its sales will exceed $330 million this year.

3. You Seek New Knowledge

Jointly owned companies are far more numerous now than they were in the 1930s because of the growing need for new knowledge. Sylvania-Corning Nuclear Corp., owned by Sylvania Electric Products Inc. and Corning Glass Works, is typical. Sylvania and Corning pooled managerial skills and knowledge to form a company in a new business, the manufacture of fuel elements. Thompson is another example of a company requiring its managers to know new technologies. It's still a supplier, strictly speaking, for vehicles, but how the means of propulsion have changed!

4. You Have Wider Knowledge

This is the age of the diversified organization, the age of the H. K. Porter Company Inc. that makes items ranging from steel to saws.

As a marketing man, you may have to make a decision about turret lathes in January, construction equipment in February, textile machinery in March—not a far-fetched example in the case of Warner & Swasey Co. Inc.

Diversification was practiced long before 1939 but never to the extent that it is now. Managers have also had to diversify their talents to an unprecedented degree.

5. You're a Pioneer

If you aren't diversifying into widely varying products, you may be called upon to help pioneer products related to your business. And they are increasingly important.

Eighty per cent of Radio Corp. of America's current business comes from products and services not on the market 11 years ago.

And where do those product ideas come from? Largely from you—managers in administration, production, engineering, and purchasing.

6. You're on Guard

Vigilance—to be abreast of technical change, product developments, marketing movements—has always been a must, but never more so than in this jet age.

Take the matter of forecasting. Population growth is a central factor in predicting economic trends. In 1950, the Census experts thought that population would reach 193 million by 1975. By 1955, they jacked up their estimate to 221.5 million. Now, they have raised the ante again. They expect a population of 235.2 million by 1975. So as a forecaster, you have to be aware of America's fertility. Then you have to relate that information to your business.

Nor is it enough to know total population gains. You also have to be on guard to figure where people will be living and what kinds of goods they will be wanting.

You are doing what the managers of a 60-man shop (Fischer Special Mfg. Co., Cincinnati) did. They changed their product mix from a general line of screw machine products to a complete line of milled aluminum and brass nuts because market surveys showed that few other companies were supplying customers the complete line, exactly where and when they wanted it.

The payoff will come for you, too, when you are on guard constantly.

So, the changing times have made you a professional manager, a vigilant pioneer—more skilled in communications, possessing more knowledge, needing more information and skills than your counterparts in the 1930s and earlier. Managerial teamwork is also more common now. You must pool talents to get all the necessary attributes.

As the economy has grown, as products have multiplied, as technology has become more complex, you have become more essential. No one chairman, president, or executive vice president can know all that has to be known to operate large, medium, or even many small companies today. You supply the knowledge, advice, and knowhow upon which top management relies in making its decisions.

You have also increased in numbers. Metalworking will turn out 240 per cent more in physical volume in 1959 than it did in 1939. But only 115 per cent more production workers are doing the job. We're finding that one of the best ways to get more work out of fewer people is to provide more and better supervision. That trend is just starting. Greater automation will put less emphasis on workers who can operate machines and more on people who can manage them.

Dilemma of Inflation

Managers have done amazingly well to adapt to and solve new problems. But so many difficulties have appeared that you haven't found answers to all. The major riddle is inflation.

Hear U. S. Steel Corp.'s Robert Tyson: "As long as nationwide wage inflation continues at rates exceeding the increase in productivity, a price inflation will be compelled."

Inflation is at the bottom of these eight problems you must deal with in 1959 and beyond:

1. Improving Productivity

Here's what happens when productivity improves faster than wages. Productivity went up 6.6 per cent per year from 1919 through 1928, when wages rose only 1.8 per cent annually. Result: Prices dropped 3 per cent each year. Productivity jumped 1.7 per cent a year from 1929 through 1938, and wages rose only 1.1 per cent each 12 months. Result: Prices dipped 1.8 per cent annually.

But from 1939 through 1946, productivity rose only 0.1 per cent yearly, while wages jumped 9.2 per cent every year. Result: The worst inflation of the century. Prices rose 5.6 per cent a year. The 1947-56 decade was also on the debit side, with prices climbing 2.8 per cent per year as productivity rose 3.9 per cent and wages climbed 6 per cent annually.

You managers have to play the role of productivity experts as you never have played it before.

2. Keeping Wages in Line

The lesson of the last 40 years is clear: When wage boosts outrun productivity improvements, we get inflation. When the productivity increases match or exceed pay gains, we have stable prices.

Your job is to hold the pay gains to no more

than the boosts in productivity, a task at which you have failed in the last 20 years.

The decline of the owner-manager has also enhanced union power. You professional managers have not yet found a substitute for the historical close relationship between owner and employees. Workers have turned to unions.

3. Giving More Public Service

One way to get closer to bluecollar people who work for you and probably live in your area is to spend more spare time in public service. That means soliciting for your community fund, or serving on your town council or school board, or participating in politics on the community level (and "community" is as broad as your horizons).

Besides contributing to closer relations with your people, public service can lead to greater influence for more equitable labor-management legislation.

4. Meeting Foreign Competition

European workers get paid only as much as our hourly people get in fringe benefits. No wonder our wage inflation is at the core of our problems in meeting foreign competition.

We have always had such trade competition, but the 1959 variety will be far different and far more serious than the type of the 1930s. Bicycle makers, watch manufacturers, and shipbuilders have lost virtually all their export business and much of their domestic volume to foreign competitors.

Machine tool builders and steel wire manufacturers face a similar fate. What can be done? Tariffs haven't worked too well. Subsidies are repugnant to all believers in free enterprise. Until the rest of the world's wage rates move closer to ours, you managers will have to rely on harder selling, higher quality, and superior technology to merely keep even with foreign competition.

5. Keeping Pace with Technology

Superior technological improvements can go a long way toward pushing productivity higher and stemming inflation.

Are you taking advantage of explosive forming, chemical milling, numerical control—or any of the other new production techniques bursting forth in this sputnik age? New alloys are legion. Even new basic metals are commercially available.

6. Increasing Research, Development

Besides keeping pace with technology, you can help your cause by developing new materials and new techniques. A recent nine-industry survey showed: The top three industries spent an average of 5.7 per cent of sales for research and development; they had a 52 per cent profit gain in a ten-year period. The middle three spent 0.9 per cent; they picked up 9 per cent in profits. The bottom three spent 0.2 per cent; they had a 3 per cent profit loss.

For the long pull, that's the best way you can find to improve productivity.

7. Improving Marketing

Too many managers handle marketing as they did in 1939, when metalworking sales came to only $17.7 billion. More sales mean more production and lower per unit costs. In 1959, you should be geared for a dollar volume seven to eight times the 1939 level.

If you're not doing that well, your managerial productivity is subpar.

8. Plugging Slow Cost Leaks

Here's a way to cut costs (and stem inflation) that's often neglected because it's so humdrum. But the leaky faucet can "nickel" you to death. Find those unglamorous wastes like excessive tool breakage, expensive sales calls, or even dripping water.

Conclusion

In just one year, you won't solve inflation or the eight corallary problems we have outlined. But you should make a start in 1959 to realize the promise of the soaring sixties and seventies.

In 1959, we'll produce 110 million tons of steel. In 1975, we'll need 250 million.

In 1959, we'll have 176.8 million people. In 1975, we'll have 235 million.

In 1959, our metalworking industry's sales will hit $135 billion. They should reach $372 billion by 1975.

This is no time for little plans. This is a threshold year. Let's make a good entrance.

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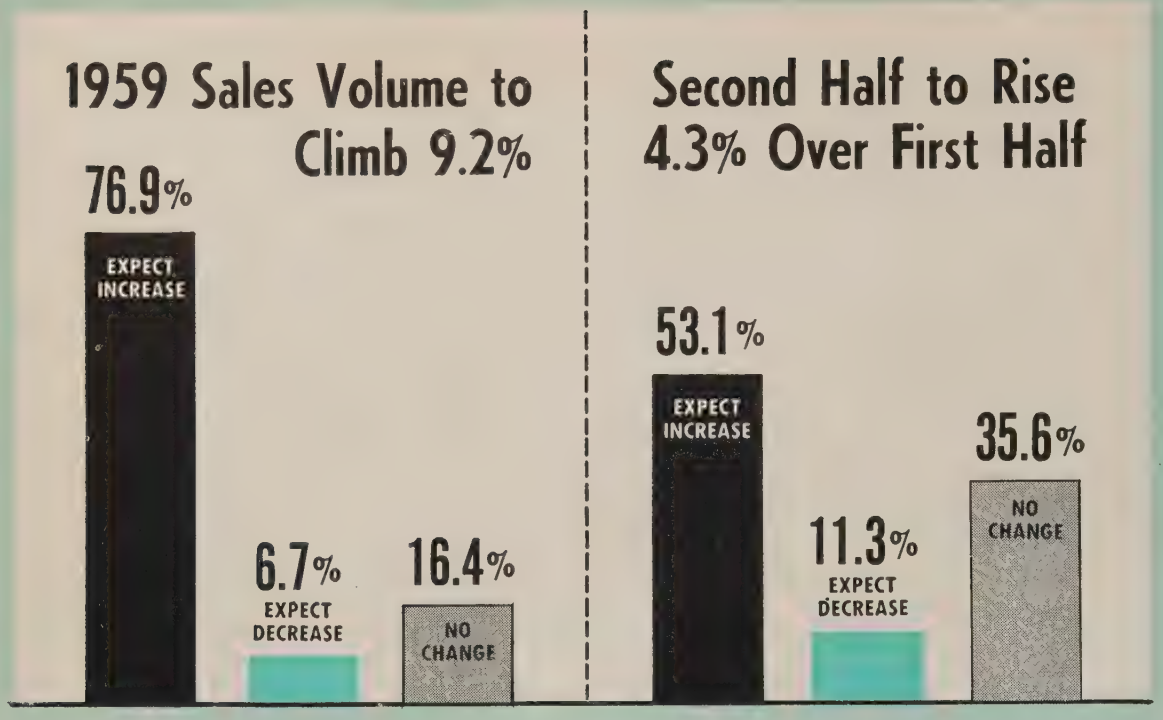
STEEL
JANUARY 5, 1959

METALWORKING MANAGERS EXPECT

9.2% More Sales In 1959

The editors of STEEL have found that one of the best indicators of the business trend in metalworking is the forward thinking of the men who manage the plants. So STEEL asked the general managers of 7500 metalworking plants what they expect in 1959—in production, prices, costs, profits, employment, research, new products, and capital expenditures. Their answers will aid you in your planning.



INCREASES EXPECTED IN SALES VOLUME DURING 1959

	1959 vs. 1958	2nd half vs. 1st half
Analysis by Size of Plant:		
Plants employing 20-99	9.0%	4.0%
Plants employing 100-499	9.1%	4.7%
Plants employing 500 or more	9.8%	4.9%
By Major Industry Groups:		
S.I.C. 33—Primary metals	11.3%	2.5%
S.I.C. 34—Fabricated metal products	7.4%	4.3%
S.I.C. 35—Machinery (except electrical)	10.1%	4.6%
S.I.C. 36—Electrical machinery	9.1%	5.0%
S.I.C. 37—Transportation	10.4%	3.8%
S.I.C. 38—Instruments, related products	9.5%	5.5%
Other metalworking groups*	11.3%	5.1%

*S.I.C. 19, 25, and 39.

METALWORKING'S dollar sales this year will be 9.2 per cent higher than they were in 1958. The second half will be better than the first.

- Profits will rise 6.1 per cent.
- Manufacturing costs will continue to climb.
- Selling prices will go up 2.4 per cent.
- Many more workers will be employed.
- Research spending will increase.
- Capacity will be expanded 2.6 per cent.
- Many new products will be introduced.
- Export sales will inch upward.
- Marketing will get added emphasis.
- Productivity improvement will be a prime goal.

That's the thinking of a majority of the nation's plant managers who participated in STEEL's annual survey of business expectations.

But their optimism is tempered by mounting foreign competition, accelerating inflation, fear of a steel strike (and another price hike), the growing power of organized labor, high taxes, and the relentless cost-price squeeze. The net result will be a vigorous, but uneasy, recovery.

• **A Good Year**—Almost eight of every ten managers replying to this year's questionnaire expect their dollar sales to be higher in '59 than they were in 1958. Only about 1 in 15 anticipates a lower volume.

The respondents predict an improvement of 9.2

Employment To Be 4.2% Higher

SKILLED WORKER OUTLOOK

7.3% EXPECT SHORTAGE

UNIT WAGE COSTS

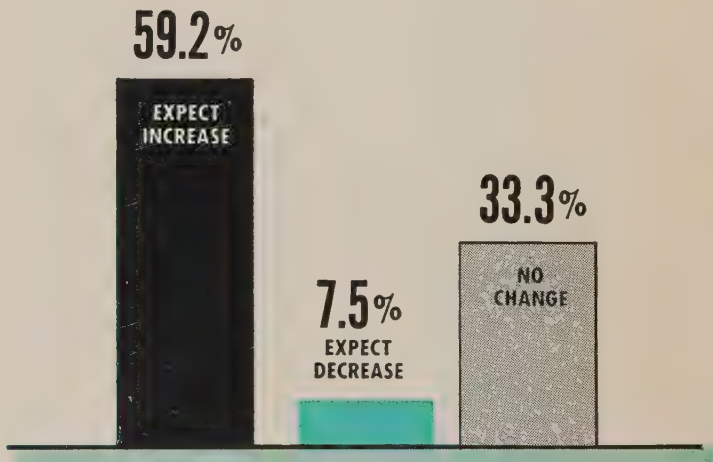
81.3% EXPECT INCREASE

5.6% EXPECT DECREASE

13.2% EXPECT NO CHANGE

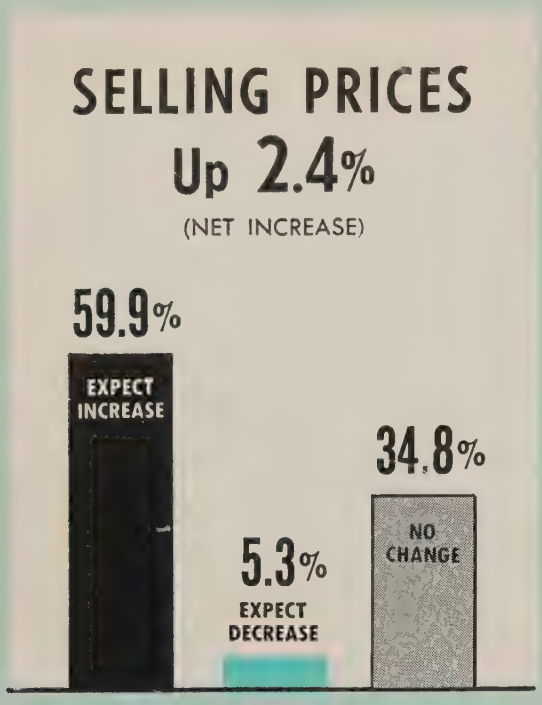
WHY UNIT WAGE COSTS WILL CHANGE:	Per Cent of Plants*
More overtime	15.3%
Higher rates	74.5%
Lower productivity	5.8%
Less overtime	3.9%
Lower rates	0.3%
Higher productivity	12.4%
Other factors	1.7%

*Figures add to more than 100% because many plants checked more than one factor.



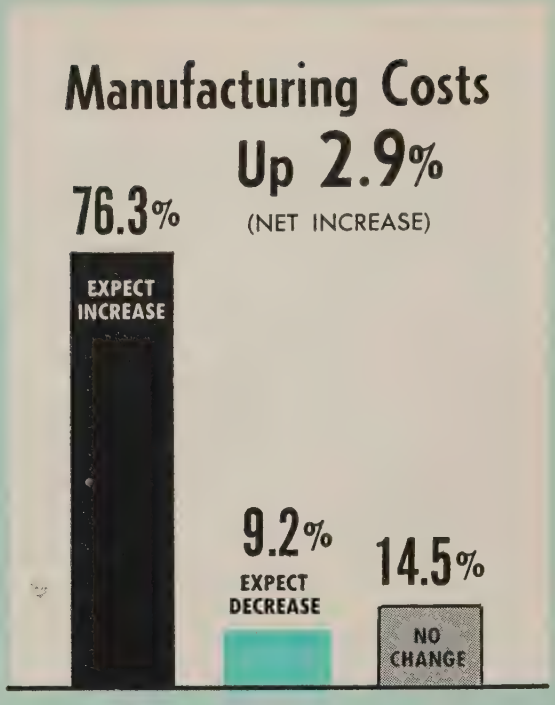
Analysis by Size of Plant:	INCREASE EXPECTED
Plants employing 20-99	4.4%
Plants employing 100-499	4.0%
Plants employing 500 or more	3.7%
By Major Industry Groups:	
S.I.C. 33—Primary metals	4.3%
S.I.C. 34—Fabricated metal products	3.1%
S.I.C. 35—Machinery (except electrical)	5.5%
S.I.C. 36—Electrical machinery	3.9%
S.I.C. 37—Transportation	4.3%
S.I.C. 38—Instruments, related products	5.6%
Other metalworking groups*	2.0%

*S.I.C. 19, 25, and 39.



Analysis by Size of Plant:	INCREASE EXPECTED
Plants employing 20-99	2.4%
Plants employing 100-499	2.4%
Plants employing 500 or more	2.5%
By Major Industry Groups:	
S.I.C. 33—Primary metals	3.0%
S.I.C. 34—Fabricated metal products	2.5%
S.I.C. 35—Machinery (except electrical)	2.7%
S.I.C. 36—Electrical machinery	1.5%
S.I.C. 37—Transportation	2.4%
S.I.C. 38—Instruments, related products	1.1%
Other metalworking groups*	2.3%

*S.I.C. 19, 25, and 39.



Analysis by Size of Plant:	INCREASE EXPECTED
Plants employing 20-99	3.2%
Plants employing 100-499	2.5%
Plants employing 500 or more	2.4%
By Major Industry Groups:	
S.I.C. 33—Primary metals	3.3%
S.I.C. 34—Fabricated metal products	3.2%
S.I.C. 35—Machinery (except electrical)	3.2%
S.I.C. 36—Electrical machinery	1.9%
S.I.C. 37—Transportation	2.7%
S.I.C. 38—Instruments, related products	1.8%
Other metalworking groups*	1.7%

*S.I.C. 19, 25, and 39.

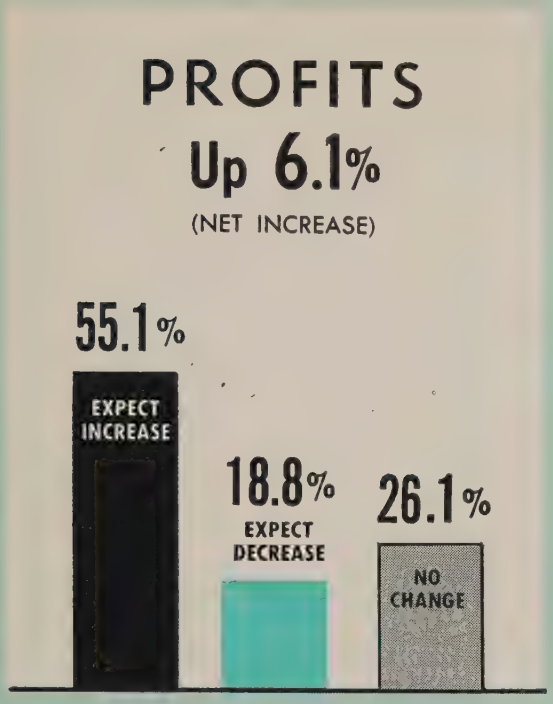
per cent over last year's estimated $119.5 billion volume of metalworking sales. So a $130.5 billion year looks like a good bet. But many of the managers term their estimates conservative. Some top executives look for sales to hit $135 billion this year. It means metalworking will regain more than half—perhaps three-fourths—of its recession losses.

• **Breakdown**—Expectations for sales gains are remarkably uniform through all industry groups, signaling a broadly based uptrend. Primary metal producers are the most optimistic. They'll have a $25.3 billion year (vs. $22.7 billion in '58, $27.9 billion in '57) if they realize their prediction.

The transportation equipment and nonelectrical machinery industries look for their dollar volumes to advance more than 10 per cent. Rising automobile sales will be the heftiest factor in an anticipated $34.4 billion year for the transportation equipment group. That's $3.3 billion above last year's mark.

• **Record Expected** — Manufacturers of fabricated metal products look for the smallest percentage gain. But the average plant in the group expects 7.4 per cent more sales than it had last year. That indicates a record year for S.I.C. category No. 34.

Makers of instruments and related products predict they'll come within $15 million of their 1957 industry volume ($3.3 billion). Last year's mark: $3 billion.



Analysis by Size of Plant:	INCREASE EXPECTED
Plants employing 20-99	4.8%
Plants employing 100-499	6.4%
Plants employing 500 or more	10.8%
By Major Industry Groups:	
S.I.C. 33—Primary metals	8.7%
S.I.C. 34—Fabricated metal products	4.9%
S.I.C. 35—Machinery (except electrical)	1.6%
S.I.C. 36—Electrical machinery	5.2%
S.I.C. 37—Transportation	5.6%
S.I.C. 38—Instruments, related products	7.1%
Other metalworking groups*	2.1%

*S.I.C. 19, 25, and 39.

• **Strong Influence**—A large number of the managers mention construction as one of the brightest spots in the 1959 outlook. They predict near-record volumes in housing starts and public building construction. They look for industrial construction to be unspectacular but healthy. Several respondents credit the road building program for predicted sales hikes. A maker of paint spraying equipment expects "increased activity due to suburban development projects."

"The Supreme Court's reversal of the Memphis Case greatly improves our outlook," reports a valvemaker who anticipates a sales increase of "at least 10 per cent." His comment is typical of oil country suppliers.

• **Defensework**—One-third of the plants surveyed are engaged in defense production. They expect Uncle Sam to buy 4 per cent more of their products this year than last. But some say defensework is becoming less lucrative because of "ever closer tolerances," "tighter controls," "a monstrous amount of paperwork," and "this devilish renegotiation." Nuclear activity is mentioned by several as an expanding market.

• **Profits Still Lag**—Eight of ten managers expect their after-tax profits this year to equal or exceed 1958's. But they don't look for profit gains commensurate with sales increases. Small plants are especially pessimistic; they look for profits to advance less than 5 per cent on 9 per cent greater sales. Two frequently mentioned reasons: Rising employment costs and keen price competition. Taxes also are blamed. Executives of small plants are divided on whether the new Congress will work to their advantage.

• **Price Problems**—"Our prices are lower than they were three years ago," complains a wire goods manufacturer. "Our profits will drop because we can't boost prices to cover wage increases," says a producer of pressure tanks. "Our prices are at rock bottom, and we're being undersold," laments a Michigan tool and die maker.

An unprecedented number of respondents call price competition their number one problem. Reports come from machinery producers, gray iron foundries, structural steel fabricators, instrument makers, appliance people, and executives in a host of other industries.

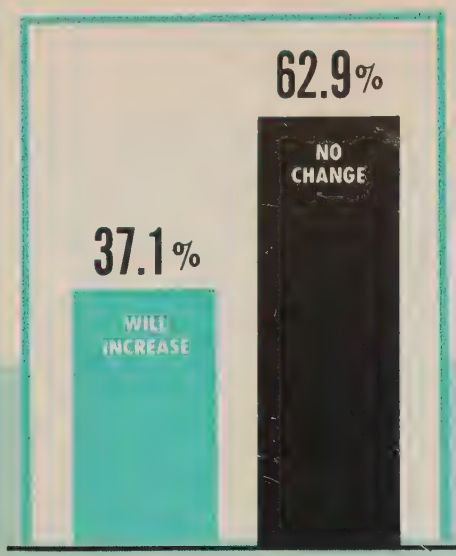
But other respondents say they'll have no part of a price war. This assertion by the president of a jobbing foundry is typical: "We're quoting prices that guarantee us a decent profit. We're selling on service, quality, and delivery. It's a lot tougher, and we lose some sizable jobs, but we believe it will pay off in the long run."

The managers predict metalworking prices will average 2.4 per cent higher this year than last, with the biggest hikes coming in primary metals and machinery (except electrical).

• **Labor Is Censured**—David J. McDonald, USW president, Walter Reuther, UAW chief, and James Hoffa, Teamsters' union boss, are the objects of some unkind remarks in this year's survey. The respondents are alarmed by the tendency of employment costs to outrun productivity increases. Coupled with competitive pricing, it spells profit problems.

A Pennsylvania metal stamper fears a profit shrinkage this year because "employment costs are rising faster than they can be offset via better methods and higher prices."

Nearly one-third of the comments on labor troubles came from Michigan manufacturers. Two say they



Production Capacity Will Be Hiked 2.6%

OF THOSE EXPECTING TO INCREASE

9.5%	34.5%	70.1%	2.6%
WILL BUILD NEW PLANTS	WILL BUILD ADDITIONS	WILL BUY EQUIPMENT	NET INCREASE

Analysis by Size of Plant:

Plants employing 20-99	7.6%	32.3%	68.9%	2.5%
Plants employing 100-499	8.6%	37.9%	72.9%	2.6%
Plants employing 500 or more	20.0%	36.2%	68.9%	2.7%

By Major Industry Groups:

S.I.C. 33—Primary metals	10.3%	30.9%	79.1%	3.9%
S.I.C. 34—Fabricated metal products	8.9%	31.6%	73.2%	2.8%
S.I.C. 35—Machinery (except electrical)	9.3%	35.3%	63.3%	2.2%
S.I.C. 36—Electrical machinery	8.4%	36.6%	71.0%	3.2%
S.I.C. 37—Transportation	10.6%	40.7%	65.3%	2.8%
S.I.C. 38—Instruments, related products	3.2%	36.4%	74.7%	3.0%
Other metalworking groups*	17.2%	36.8%	69.4%	1.6%

*S.I.C. 19, 25, and 39.

are relocating "in a southern state that has a right-to-work law." Several others report they are considering such a move. A heat treater reports his "customers are moving out of state."

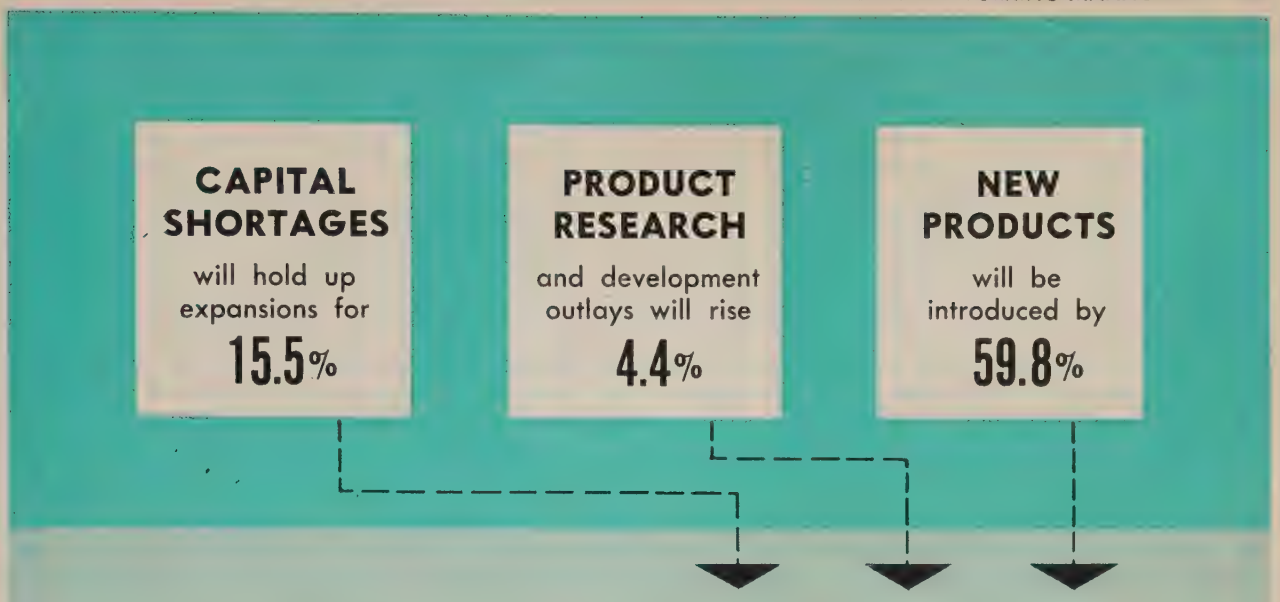
Some respondents lay the blame for the wage spiral on Big Steel and Big Autos. Others echo this thought offered by the president of a porcelain enameling company: "It should be every manager's responsibility in 1959 to resist labor demands and concentrate on improving the efficiency of production." Another respondent suggests that management can help halt the wage-price spiral by "taking a more active part in politics."

One respondent asserts: "Our fringe benefit costs are higher than the total employment costs of our foreign competitors."

• **Imports Cause Alarm**—Foreign competition is listed as problem number one by a hefty percentage of the respondents. Western Europe, Japan, and even Communist dominated nations are flooding U. S. markets with a wide assortment of metal products which sell at bargain prices, the managers report. Imported steel is being offered in the Midwest at prices below U. S. producers' costs.

The threat from abroad is no longer limited to a few items, like toys, bicycles, wire goods, and cameras. Machine tool builders, auto suppliers, producers of oil country goods, instrument makers, and a host of other metalmen say competitive imports are being peddled right in their own backyards. Source of alarm to many managers: Foreign producers are narrowing the quality gap between their goods and those made in the U. S.

Foreign competition in export markets is even broader and more severe, the managers report. They look for metalworking's dollar volume of exports to climb only 1.9 per cent above 1958's unimpressive showing. To compete in export markets, they'll extend more credit, visit more foreign customers, design products for export markets, participate in trade



Analysis by Size of Plant:			
Plants employing 20-99	19.4%	3.6%	55.3%
Plants employing 100-499	12.4%	4.8%	63.0%
Plants employing 500 or more	6.6%	6.4%	71.1%
By Major Industry Groups:			
S.I.C. 33—Primary metals	16.1%	2.7%	31.2%
S.I.C. 34—Fabricated metal products	16.4%	3.3%	50.2%
S.I.C. 35—Machinery (except electrical)	17.2%	4.6%	66.7%
S.I.C. 36—Electrical machinery	14.9%	6.3%	82.6%
S.I.C. 37—Transportation	9.0%	5.1%	50.8%
S.I.C. 38—Instruments, related products	7.1%	6.8%	86.8%
Other metalworking groups*	16.2%	5.2%	70.5%

*S.I.C. 19, 25, and 39.

fairs, reduce prices, and work more closely with foreign distributors.

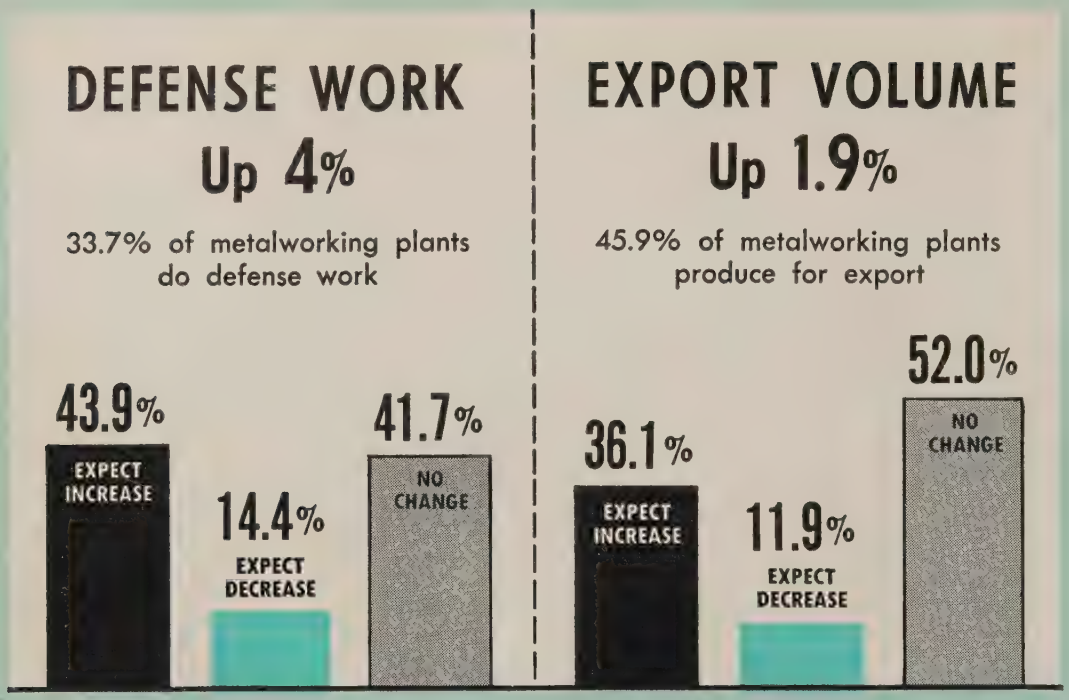
• **Plant Expansion** — Another problem frequently mentioned by respondents is a lack of funds needed to purchase new equipment. Capital shortages will curtail planned expansions for one out of six metalworkers. Excess capacity burdens others. Several say changes in depreciation laws are urgently needed.

Despite such difficulties, metalworking capacity will be boosted 2.6 per cent this year. Primary metal producers will hike theirs the most—3.9 per cent. Equipment additions will account for a major portion of the over-all advance.

• **Research Outlays Up**—Product research and development expenditures will set a record again this year. Only 2 per cent of the respondents will reduce their outlays. The instrument and electrical machinery industries will fatten R&D budgets the most. More than half the plants employing 500 or more will hike their outlays.

These comments summarize the main reasons for the boosts: 1. "We want to be ready for the new boom"—Rhode Island partmaker. 2. "Exclusive designs always boost demand"—New England manufacturer of consumer goods. 3. "Higher quality will help us sell in today's competitive market"—electric battery maker. 4. "Redesign will lower our manufacturing costs"—midwestern machinery producer. 5. "We need a broader product line"—Michigan auto supplier. 6. "We plan to enter new markets"—Tennessee foundry.

• **Strike Feared**—Several respondents says a prolonged steel strike would hold their 1959 production below what they now estimate. Others say they will surpass their predictions if there is a peaceful steel settlement. Many worry that there will be a bigger steel price hike this year than last. Some have already started building inventories in anticipation of a strike-induced shortage and a price increase. Others say they will do no hedge buying;



	Produce for Defense	Volume Increase Expected	Produce for Export	Volume Increase Expected
Analysis by Size of Plant:				
Plants employing 20-99	30.3%	4.4%	39.5%	1.8%
Plants employing 100-499	31.8%	2.3%	50.6%	2.0%
Plants employing 500 or more	52.1%	5.8%	62.4%	2.1%
By Major Industry Groups:				
S.I.C. 33—Primary metals	33.5%	1.9%	22.7%	1.1%
S.I.C. 34—Fabricated metal products	26.8%	2.4%	35.2%	1.7%
S.I.C. 35—Machinery (except electrical)	34.8%	5.0%	57.1%	3.3%
S.I.C. 36—Electrical machinery	44.2%	4.6%	57.3%	0.3%
S.I.C. 37—Transportation	46.2%	7.0%	41.5%	0.2%
S.I.C. 38—Instruments, related products	57.1%	3.3%	67.2%	2.5%
Other metalworking groups*	15.5%	1.8%	50.8%	0.6%

*S.I.C. 19, 25, and 39.

they fear a recurrence of the inventory imbalance that was so widespread during the recession.

• **Goal: Higher Productivity**—Many of the managers say one of their prime tasks this year will be finding ways to improve productivity. They won't depend on higher volume to lower unit costs of labor and overhead. One producer of hydraulic products has established a goal of "25 per cent more efficiency in 1959 operations."

The managers say here are some of the methods they'll use to get higher productivity: 1. "Automation"—Michigan stamping plant. 2. "Tighter controls throughout the plant"—New England steel fabricator. 3. "Standardization of materials and supplies"—producer of trucktrailers. 4. "Methods improvements"—gray iron foundry. 5. "Better tooling and more efficient equipment"—California metalworker. 6. "Products designed for simpler production"—appliance maker. 7. "A better incentive system"—New York foundry.

• **Wrapup**—The hefty gains in production and the wide array of problems pointed out in this year's survey signal a busy 12 months for the nation's metalworking managers.

• *Extra copies of this survey are available in quantities from one to three until supply is exhausted. Write Editorial Service,* STEEL, *Penton Bldg., Cleveland 13, Ohio.*

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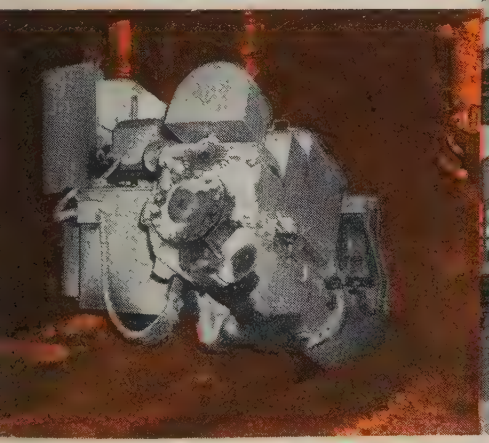

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'59: Countdown Year for the Dems Aiming at '60 Election

THE DEMOCRATS are preparing to blast off in 1960. But the success of their political rocket at time zero will depend upon a series of legislative events in 1959. The countdown:

• **TEN — Social 'Progress'** — The party counts on the voters buying a policy of a "better" America. Included is an extended, and more expensive, social security program, which may not reach fruition until the summer of 1960 but which will be widely heralded by liberals this coming year. Party strategy is to avoid a vote until next year when even conservatives will find it politically difficult to oppose social security.

The construction industry will have a huge stake in Democratic plans for highways, housing, airports, and schools.

Highways—Industry groups like the Automobile Manufacturers Association, highway officials, farmers, even consumer groups like the American Automobile Association, are forming a solid front against increased gasoline taxes, which would put the Highway Trust Fund back in the black. (It has been operating at a deficit for several months.) Under the Byrd pay-as-you-go amendment to the highway act, federal road programs must be financed from the trust fund, rather than general Treasury money.

The outlook is for repeal of the Byrd amendment under the leadership of highway enthusiast Sen. Albert Gore (D., Tenn.). Until the Bureau of Public Roads presents Congress with a new analysis of highway financing problems (due in 1961), look for such stopgap measures as bond issues to keep the trust fund from dropping clear out of sight. A move to finance roads directly from general revenues will have strong appeal to many liberal Democrats, but economy may triumph for a while. For industry, the point is simple: Continuatio of the Byrd amendment will sto the road program flat, at a tim when it is about to live up to it original promise.

Housing — With economists a ready predicting a slackening of ne housing in the last half of 195 early efforts to push through an ex panded Federal Housing Adminis tration program can be expecte Rep. Albert Rains (D., Ala.), chai man, Housing Subcommittee of th House Banking & Currency Com mittee, will ask for another $4 bi lion to finance homes. He will b backed in the other house by Se John Sparkman (D., Ala.), Housin Subcommittee chairman. Both wi also push to get the Budget Burea to unfreeze $1 billion in funds hel back this year.

Many Democrats will vote to low er the interest rates on GI house But the banking fraternity wi probably be successful in forestall ing the move.

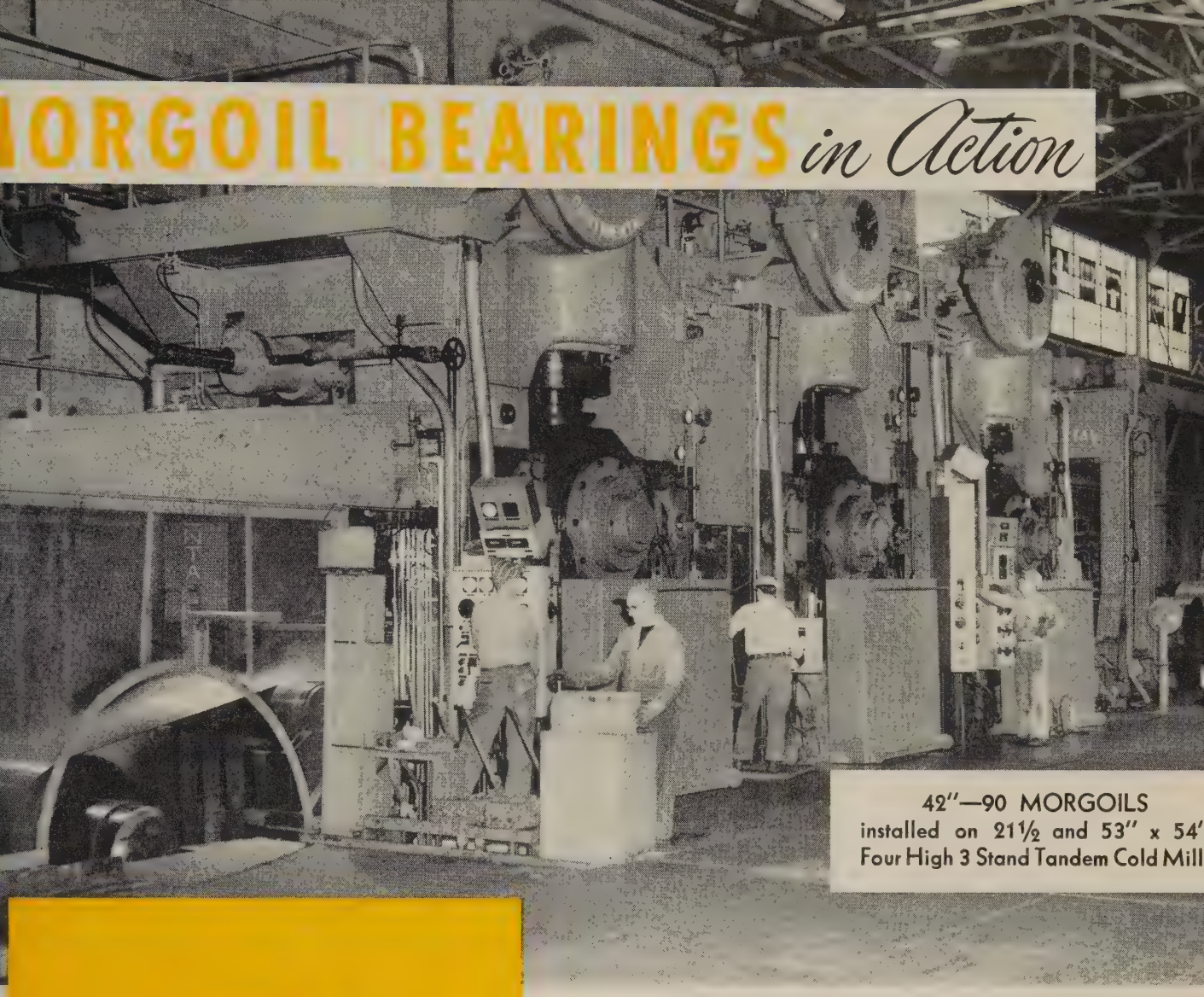
The U. S. Chamber of Commerc will run into a real fight as it a tempts to kill off urban renewal, du for re-evaluation next session.

Airports—Sen. Mike Monroney (D., Okla.) jet age airport progra ($100 million a year) will pass with out a hitch. He is also expected t take an interest in the airline indus try's jet financing problems.

Schools—Barring the heavy han of economy minded southern Demo crats like Sen. Harry Byrd (Va.) a school program stands the bes chance of passage it has ever had Sen. James Murray (D., Mont.) wi start the ball rolling in his Edu cation Subcommittee.

• **NINE—Special Interests**—Wit Republican aid, some Democrats wi try to broaden programs designe to help such special interests a small business and the minin industry (which also have plent of vote appeal). Look for Re Wright Patman (D., Tex.) to tangl with the Small Business Adminis tration over its new investment pro gram. The congressman will charg the Small Business Investment Ac is run by and for the "Wall Stree bankers." He will also carry thi fight over to his annual attack

MORGOIL BEARINGS *in Action*



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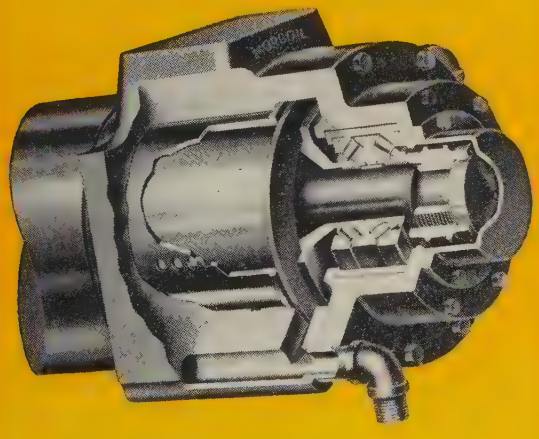

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MB-33

What to Expect From Congress This Year . . .

	GOOD CHANCE	POOR CHANCE	COMMENTS
Airport building	x		Another Presidential veto of increased spending will be overridden.
Antitrust law "strengtheners"		x	Noise will come from Senator Kefauver but no definite proposals.
Atomic energy program expansion	x		AEC will get more R&D money; civil reactor program should be speeded up.
Auto dealer territory "security"		x	The trend seems to be just the opposite: Such a law might be unconstitutional.
Barter speedup		x	Congress will go no further than it did last session, unless State Department changes its tune.
Controls (standby) of prices and wages		x	Increased sentiment for these measures won't prove strong enough.
Corporate tax reduction.		x	Some of those who most favored it won't be around this year.
Debt ceiling increase	x		Absolute necessity with fiscal 1959's huge deficit.
Defense budget boost over Ike's recommendation of January, '59	x		By summer (when Congress turns to appropriations) even the Budget Bureau will O.K. another $1 billion, unless the Russians switch from missiles to Mixmasters.
Defense department streamlining		x	That battle was lost in 1958.
Depletion allowance reduction	x		Senator Proxmire had 31 votes in the Senate on his side last session.
Depreciation reform		x	Industry has yet to forcibly present its case to Capitol Hill.
Depressed area help	x		Unemployment will stay higher than normal this year.
Employment Act changes		x	Business and labor don't seem able to compromise their views on what amounts to wage controls, on one hand, and true "full" employment, on the other.
Fair Trade Law rebirth		x	The pros will get little encouragement from freshmen congressmen.
Federal Reserve System control by Congress		x	Representative Patman will try, and try, and try again, and again.
Foreign aid spending decline	x		Ike will ask for more than he got last year, and he will get less.
Foreign investment aids	x		A Space Age Congress appreciates the international point of view (when it doesn't cost too much).

(*Please turn to Page* 114)

on the Federal Reserve System. T tightening of money will be e dence for him that small busin is having a rough time. He m reap some success in a brawl o interest rates the SBA is chargi new investment firms.

The mining interests will feel l secure in the new Congress th the last. Metropolitan represen tives from the Democrat side of t aisle did a lot to kill the Seat plan; western Democrats appe stronger and may offset some the urban Democrats' gains. T South holds the balance. A sout ern-western alliance would be wor able this year if the South nee votes in its civil rights fuss, but t would involve Senator Byrd. He not likely to vote for subsidies.

Dark horse for the miners is plan to stabilize production at stated percentage of domestic ma kets—Sen. Gordon Allott (R., Colo started talking it up in the last se sion.

• **EIGHT — Depressed Areas** — A essentially Democratic program w get help next session from the libe al Republicans. Sen.-elect Hug Scott (R., Pa.) has served noti he will introduce legislation costin somewhat less than the program I vetoed last year. The cost still e ceeds the plan for $75 million t administration was willing to pus at the recession's depths. Depresse area legislation is a certain vote ge ter for the Democrats; liberal R publicans from industrial stat where unemployment still ru above normal will be bound to fo low Senator Scott.

• **SEVEN—Taft-Hartley**—Here li the major test of union control the Democratic party. Since N vember, conservatives have said i dustry faces a labor controlled Co gress; they will be proved right wrong when the liberals introdu a bill to kill Taft-Hartley's allow ance for the open shop. The issu will not necessarily be one that t Democratic leadership is willing tack high on its banner. Observe look for southerners to rally Repu lican and western Democrat strength to keep the open shop. B few expect T-H to be modified i favor of business: Secondary bo cotts, for example, will still be wit us after Congress goes home.

It does not appear that Dem

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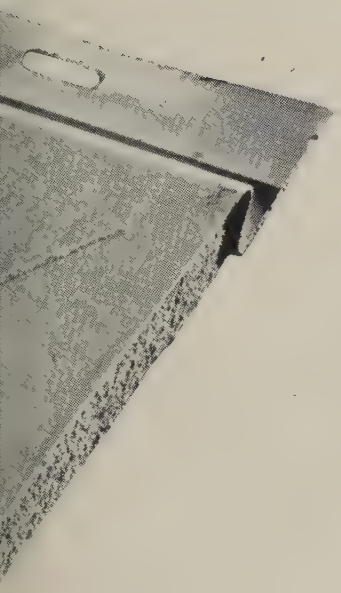

In two hundred plants—many of them the leaders in their particular fields of aluminum fabrication—Bonderite for aluminum is being used today!

Bonderite makes it possible to take aluminum in the coil, run it through a continuous line in which the strip is cleaned, Bonderized, roll-coat painted, dried—and then recoiled.

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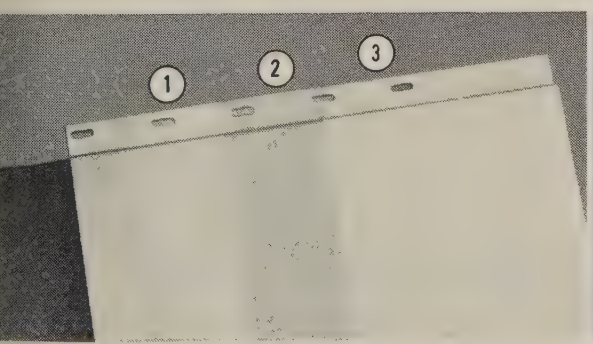
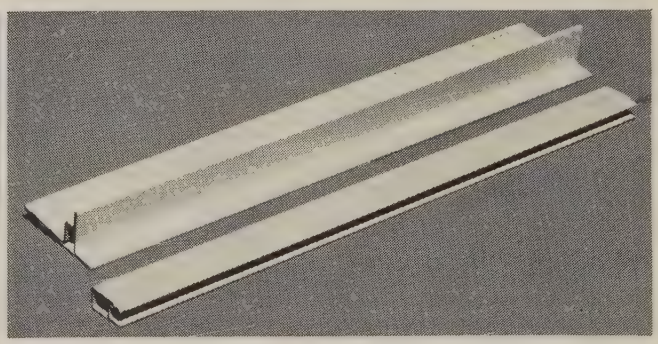


Here's the 1-2-3 for durability of painted aluminum. Section of siding shows bare aluminum, (1); Bonderite treated, (2); and roll-coated paint, (3).



These aluminum window and screen frame sections were Bonderized and painted in the strip and formed after painting. There isn't a break in the finish anywhere!

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(Concluded from Page 114)

cratic hopes for 1960 depend too much on their treatment of T-H. Right-to-work strength in Kansas was enough to show the party that the union side is not always the side where its bread is buttered.

• **SIX — Foreign Relations** — Both parties agree our economic relations with the rest of the world need re-evaluation. Republicans generally favor outright tax reductions on foreign investments; Democrats seek a tax deferral approach so their legislation doesn't smack of too much help to big U. S. firms.

The cold war with Russia will have a lot of importance here. If the Communists let matters quiet down, both parties would be inclined to accept a compromise. But if Russian competition for U. S. markets grows, which appears likely, the issue will have prime political importance.

A byproduct will be the Mutual Security Act appropriation bill. Economy here is easy yet dangerous in terms of national security. Substitution of investments for loans appears to be a fair compromise, if all interests can be satisfied.

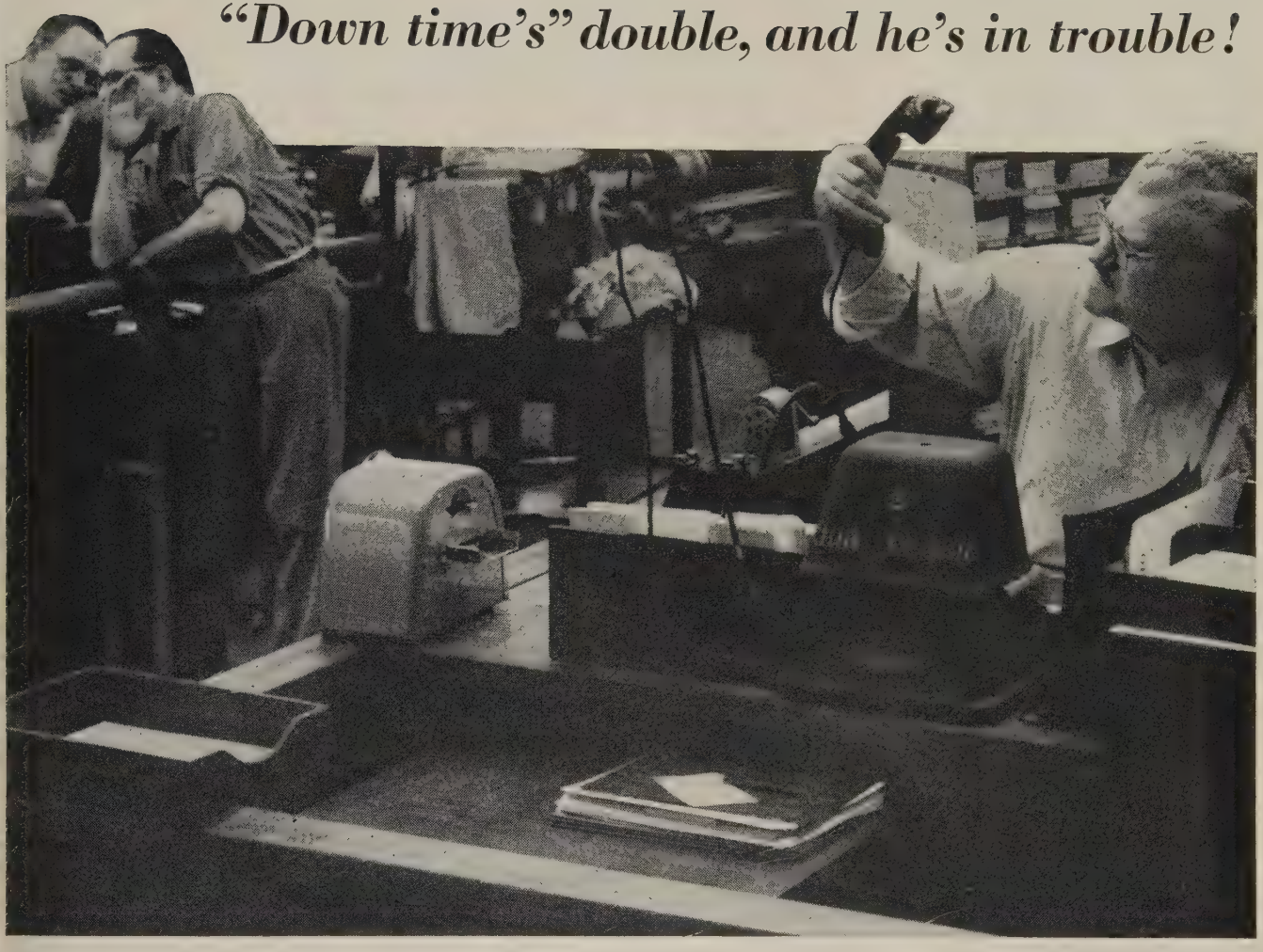
• **FIVE—Antitrust**—Hopes of the liberals run high for tougher anti-trust laws. A few are talking of a new trust-busting era. The first test will come on the reaction to the prenotification of mergers bill which has been around Congress for several years. A strong vote for it will encourage the likes of Sen. Estes Kefauver (D., Tenn.) to greater efforts.

• **FOUR — 'New Era' Legislation** —The water shortage, air pollution, and atomic energy are examples of problems the Democrats feel must be solved before they return to the voters in 1960. If they can bull through comprehensive plans to have economic electricity from nuclear energy by the 1970s, to get fresh water from salt water, and to guarantee us all clean air, they think they have as good a group of vote getting issues as any party could hope for.

• **THREE—Space**—Trips to Mars for your grandchildren seem to be a part of the big plan. Sen. Lyndon Johnson (D., Tex.), the party's most vocal leader in space matters, will be

	GOOD CHANCE	POOR CHANCE	COMMENTS
Highway legislation: Increased gasoline taxes		x	The states like to keep gaso for their own revenue needs as possible.
Byrd amendment suspension	x		Otherwise the federal program lapse.
Housing legislation: More mortgage funds	x		Look for FHA to be boosted a ened in concept.
Lower interest rates		x	After all the shouting, "No."
Import controls		x	State Department will contin the major trends.
Inflation controls		x	The boom will not return fas to scare Congress.
Kennedy-Ives labor bill	x		It is the easiest for most to liv
Labor-management relations	x		A national level committee re both sides will be recommende gress to meet periodically.
Latin American aid	x		Tax benefits will be offered; ne encouragements are likely.
Manufacturers' sales tax		x	An over-all tax makes it too di Congress to grant special favors interests.
Merger prenotification	x		It looked like a cinch last yea
Mineral program		x	The Seaton plan isn't mobile for the Westerners. They pref at the problem piecemeal.
Minimum wage increase	x		To $1.25 an hour, but broader is less likely.
Personal tax cuts		x	A sincere effort to lower th bracket rates will founder.
Postal rate increases	x		Where else can they go but up
Public works program boosts	x		Across the board. This is the certain to exhibit the "liberal" cies of the new Congress.
Railroad loans		x	They didn't like what they session.
Renegotiation reform		x	Industry needs to present a sol
Research spending boosts	x		National Science Foundation sh well.
Right-to-work changes		x	Labor seeks amendment of Taf to ban the open shop, but th will kill the effort.
Russian trade encouragement		x	Moscow won't let up the cold v
School construction	x		But housing, highways, and defe priority.
Science cabinet post	x		The argument: Too many of ou istic" programs are run by no departments. Example: Weath trol is run by Commerce Depart
Shipping help	x		Higher subsidies must be passed increased foreign competition.
Small business loans		x	Enthusiasts will try to prove la aid wasn't good enough.
Social security expansion		x	Plenty of talk this year in pre for a big push in the election 1960.
Space agency budget boost	x		Ike will ask for $500 million; will give him $1 billion.
Union power controls		x	This isn't the right Congress.
Water resource development	x		Saline conversion, yes; public d less likely.

"Down time's" double, and he's in trouble!



Alas, poor foreman! The plant manager is really blowing up. And so soon, too!

For the idle man-hours he's beefing about were chalked up only yesterday. Yet the whole story was on his desk today—thanks to the speed of Automatic Keysort punched-card controls.

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NEW CONCEPTS IN PRACTICAL OFFICE AUTOMATION

Business and the 86th Congress:

SIX MAJOR ISSUES

CORPORATE TAXES

If basic reform (like progressive decreases in corporate taxes proposed in the Sadlak-Herlong Bill) is what most businessmen want, Congress has yet to learn it. Emphasis of leading business groups on economy in government makes such tax reductions seem illogical to many congressmen in view of the deficit of fiscal 1959, and the possibility of another deficit in fiscal 1960. Economy probably could be achieved in many relatively small areas, say many congressmen, but great savings in the major areas like defense, farm programs, mutual security, veterans' benefits, and interest on the national debt appear unrealistic to them.

DEPRECIATION

Most of those on Capitol Hill familiar with industry's need to re-equip know the U. S. doesn't have the best system of depreciation. Yet, when Internal Revenue Service asked for advice, response from industry was negligible. Only the big associations of businessmen consulted IRS, whereas a wealth of individual response had been hoped for. It is difficult, and sometimes politically dangerous, for your representative to line himself up with the so-called pressure groups of business.

HIGHWAY & HOUSING

More money from Uncle Sam is going to be needed to keep these programs rolling at top speed. Does industry want that or would it prefer to see a slowdown as an anti-inflationary effort?

LABOR-MANAGEMENT RELATIONS

The hue and cry about bad practices was not confined to the unions alone, as the McClellan Committee showed. Industry must draw up its own code of ethics for dealing with its employees, say many congressmen.

RENEGOTIATION

Some business groups want it killed; some want it modified, and they can't agree how. It is not a problem for the bulk of STEEL's readers today, because the $1 million floor protects many firms. If a workable and livable law doesn't come out of the new Congress, however, the stage will be set for more problems later as more firms become eligible for renegotiation.

RUSSIAN TRADE

The scrap industry is still living with the fact that it sold scrap to the Japanese just before Pearl Harbor. Yet, Russia is a fabulous market for U. S. products and knowhow. The new Congress may well set Policy for trade with the Communists for years to come. Have you let your congressmen know how you feel about this issue?

in on more investigations of the speed and efficiency of our National Aeronautics & Space Administration. The agency is likely to get more money than it asks for.

• **TWO — Defense —** Leaders like Sen. Stuart Symington (D., Mo.), who maintains big hopes for the Presidential nomination, and Sen. Henry Jackson (D., Wash.) will give us more statements on national defense, guaranteed to make us fighting mad or scared to death. They'll scoff at Ike's budget request for slightly more spending than fiscal 1959. The Democrats will push the defense budget up as far as they dare. They're not willing to wait for Russian successes to tag them as the party that wouldn't spend to insure U. S. supremacy.

• **ONE — Inflation —** The biggest issue of all to the voter: How much is he getting for his dollar in the supermarket, the department store, and at his friendly auto dealer. Last month, economists started to wrangle with the problem of rewriting the Full Employment Act before the Joint Economic Committee. They disagreed violently: Business groups generally want the act to include a reference to stabilized prices; unions claim such wordage would submarine the act's intention to create an economy in which everyone is employed. Neither party, of course, wants a depression to keep prices down, and neither wants full employment to become synonymous with roaring inflation.

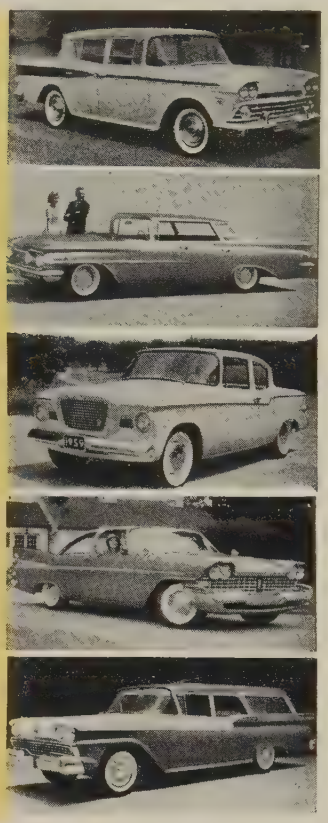
The state of the economy appears to be in the Republicans' favor. No one expects inflation to more than creep this year. If it speeds up rapidly next year, the Democrats have a readymade issue.

The economy forces in Congress, led by Sen. Harry Byrd (D., Va.), will back Ike's balanced fiscal '60 budget. From fiscal '54 through '59, U. S. spending jumped from $67.8 billion to $81.7 billion. The increase has been in domestic, not foreign, spending. Foreign spending, including the budgets for defense, Atomic Energy Commission, and the Mutual Security Act, declined by $300 million in the period. Domestic spending climbed almost $14 billion. Biggest rises: Veteran aid, farm aid, labor-welfare programs, general government costs, dept interest, housing, roads.

U.S. Auto Production

(Units)

	1959†	1958*	1957	1956
GM	2,713,000	2,153,000	2,816,000	3,062,000
FMC	1,675,000	1,208,000	1,890,000	1,669,000
Chrysler	790,000	624,000	1,222,000	870,000
AMC	312,000	210,000	114,000	104,000
S-P	83,000	55,000	73,000	96,000
Totals	5,573,000	4,250,000	6,115,000	5,801,000



†Projected. *Preliminary. Adapted from *Ward's Automotive Reports.*

1959: Autodom's Make-Ready Year

AUTODOM'S preoccupation with cost reduction underlies many of the developments which will capture the headlines in 1959—the small car, the aluminum engine, standardized parts, greater use of aluminum, plastic tooling, cold forming, and decentralization.

• **Small Cars Coming** — Detroit knows that GM's Fisher Body Div. has released some tooling orders for an economy car body. Some of the cars will be built at Chevrolet's Willow Run, Mich., facilities. Two models are planned, both on a 106 in. wheelbase. One will be marketed through Chevrolet dealers; the other will be handled by other divisions.

Sources at the corporate level say the car could be introduced as early as June if GM's sales lag, but if the market holds at the 5.5 million level or above, it's more likely that General Motors will wait until the regular introductory season.

• **Competition**—Ford Motor Co. is close behind GM. It also has two models; one is a station wagon. Its engine line at Lima, Ohio, is already turning out the revamped Ford industrial engine which will have performance characteristics similar to the Ford Taunus powerplant (See STEEL, Dec. 15, 1958, p. 99).

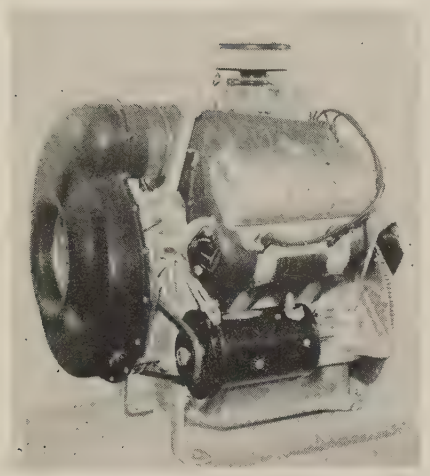
Chrysler's plans aren't as far along, although design studies of its car are being completed. It could be ready for production by late 1959. Union sources report Chrysler told them the car will be built in the Dodge Main plant, Hamtramck, Mich. Chrysler asserts it is only studying the possibility.

• **Market Looks Up** — GM's decision to go ahead with a smaller car indicates the industry believes the demand for economy will hold up through 1965.

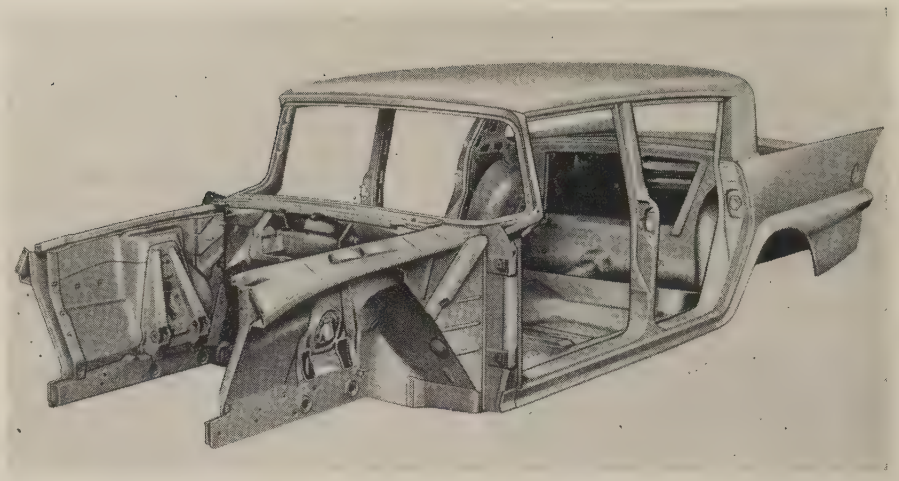
The industry expects to see at least 900,000 economy cars sold in the U. S. this year. Some 400,000 will be imports. This leaves half a million economy jobs to be marketed mainly by American Motors Corp. and Studebaker - Packard Corp. George Romney, AMC president, predicts sales over 300,000 units for his company. S-P's projections call for 83,000 Larks.

• **Aluminum Engine Bows**—With the smaller cars come aluminum engines. Foundrymen view this breakthrough with alarm, but automotive designers are enthusiastic because the light engines require less machining time and make for better weight distribution.

GM's powerplant will be of the



This AMC, 4 cylinder, air cooled, aluminum engine is a forerunner of the powerplant for 1960's small cars



The unitized body is now only on the Rambler (above), Lincoln, and Ford Thunderbird. But Chrysler Corp. will unitize all but the Imperial, and General Motors is considering at least partial unitization

Porsche design with gray iron finned cylinders sandwiched between a permanent molded aluminum head and crankcase.

The other aluminum engine will be a fairly conventional, 6 cylinder diecast design for Chrysler. It apparently will be of wet sleeve construction with iron particles impregnated into the aluminum by means of a unique diecasting technique. Details are sketchy, but talk has it that polished stainless core pins will be sprayed with iron. After the shot, cold water is injected through the pins, causing them to shrink slightly. As they're withdrawn, the rougher particles of iron adhere to the liner walls. Lining thickness will be about 0.020 in.

• **Big Cars** — Detroit's standard products will also get the economy treatment. Design integration will be aimed at: 1. Redesigning components so several parts can be made as a single unit. 2. More standardization so more parts can be used interchangeably.

One way to realize more integration is to use unitized construction. GM and Ford small cars will have it. Chrysler reportedly was going to unitize only Plymouth bodies, but now it's known that all Chrysler lines except Imperial will get this body building treatment. It won't be the AMC version. Front fenders and firewall assemblies will be welded together and reinforced with framing members. The same will be done on rear quarters. Front and rear ends then will be hung on a shortened semiladder type frame.

After much cost probing, the Lincoln people decided to continue with unitized construction through 1960. Beyond that, it still appears that this car will switch to a common body and frame that can be shared with Mercury. While GM has not made up its mind, the corporation is firmly convinced that standardization will pay off better with unitized body components. Like Chrysler, GM appears most intested in the partial unitization approach.

• **Standardization** — In another move to reduce costs, GM will continue the standardization trend it started in 1958. Chrysler has already made many of its parts interchangeable. Ford will follow suit this year. The next big items on the list are brakes, driveshafts, and axles.

GM's Fisher Body Div. has explained that standardization makes for annual styling changes. Chevrolet already has released orders to revamp dies for its third styling change in as many years.

Auto Plant and Equipment Spending

1959†	$600,000,000
1958*	577,000,000
1957	1,058,000,000
1956	1,689,000,000
1955	1,128,000,000
1954	1,295,000,000

†Projected.
*Preliminary.
U. S. Department of Commerce.
Automobile Manufacturers Assn.

• **Drive Lines**—Rear transmissions will be the breakthrough in this area. GM's Trans-axle has been shelved for 1960, but there's a possibility Lincoln may offer its version on the '60 models. Other transmission advances will follow the pattern laid down by Ford. GM is improving Dynaflow and redesigning the Hydra-Matic into a slim line model. Detroit Transmission Div. is working on an inexpensive two stage Hydra-Matic to compete with Ford's low cost job. It probably will appear first in GM's economy cars.

• **Brakes**—Designers still haven't made much progress toward a practical brake that's inexpensive enough to warrant production release. Most promising developments seem to be a semidisc type similar to the Girling unit. Liquid cooled jobs still are being studied by Lincoln.

The brake problem will be lessened this year by the use of diecast integral wheel and drum combinations made of aluminum. Chrysler reportedly will have them on some 1960 models. Two GM divisions are expected to make the move. Ford's plans are uncertain.

Forming Methods Cut Costs

Motordom's next big manufacturing objective is to sharpen methods. It wants to convert raw materials

CASE HISTORIES

Exclusive Sentri-Seals effectively seal out foreign materials at temps up to 225° F for extended periods — up to 350° F for shorter periods. Made of Buna-N, they are compatible with silicone, petroleum and diester lubricants.

Photo courtesy: Thor Power Tool Company

Bearings Seal Out Abrasives...Allow Cool Operation In 21,600 R.P.M. Grinder!

CUSTOMER PROBLEM:
Tool manufacturer requires bearing design that will seal 21,600 r.p.m. grinder from abrasives . . . yet heat must be minimized for operator comfort since tool is hand held.

SOLUTION:
N/D Sales Engineer recommended a group of four New Departure integrally enclosed bearings . . . some with Sentri-Seals. These precision ball bearings successfully shut out microscopic grinding abrasives. And, even with such positive sealing, the virtually friction-free New Departures help keep the temperature low enough for comfortable hand operation. They're sealed and lubricated for life . . . promising trouble-free ball bearing performance without the added burden of periodic maintenance.

For immediate analysis of your current ball bearing problems, call the New Departure Sales Engineer in your area or write Dept. T-1.

Available through United Motors System and its Independent Bearing Distributors.

NEW DEPARTURE

DIVISION OF GENERAL MOTORS, BRISTOL, CONN.

NOTHING ROLLS LIKE A BALL

Optional Equipment Installations

(Percentage of model year output)

	V-8 Engines	Automatic Transmissions	Power Steering	Power Brakes	Power Seats
1959*	77.1	78.5	41.3	29.7	7.7
1958	76.2	77.5	40.7	29.2	7.3
1957	82.5	79.1	35.6	27.8	6.7
1956	80.9	75.1	27.2	24.3	6.6

*Projected. Adapted from published R. L. Polk Co. data.

into finished parts with the fewest possible operations. The industry is convinced cold forming techniques offer the greatest potential, although cheaper forging and casting methods won't be neglected. Here are five examples of trends in materials and manufacturing methods that will grow this year:

• **Cold Forming** — GM's Saginaw Steering Gear Div. used automatic screw machines to make slugs from which its universal joint bearings are formed. This year it scrapped the multiple spindle jobs and is cold drawing coil steel and knocking the slugs off in a cold header.

Savings are 16.8 per cent per part.

• **Cast Steel Dies**—GM's Oldsmobile Div. is making cast steel dies for forged parts. Casting to 0.005 in. tolerances eliminates expensive die sinking operations. Die costs are cut almost 50 per cent, and production life is equal to that of wrought dies.

• **Cold Lubrication**—By using a cold, roll-on lubricant, Fisher Body, Ford, and Chrysler stamping plants can switch to lower cost commercial grade cold-rolled steel in place of drawing quality sheets for many stamped parts.

• **Aluminum**—Some 57 lb of aluminum are going into the average 1959 car. Aluminum producers indicate the average will be about 62 lb in 1960. About 40 per cent will be diecastings which provide close tolerances and usually require little buffing, polishing, or trimming. Elimination of the costly operations and lower handling charges (because of molten metal contracts) make aluminum a natural for continued use in the 1960s.

• **Plastic Tooling**—It's already successful for short run production dies and light jigs and fixtures. Next year, the industry will impregnate plastic with metal and cast it into dies to get longer production life. Metal impregnated plastic dies can be used to turn out parts for low volume lines like Dodge, De Soto, and Pontiac. Car designs no longer call for the deep draw stampings that require heavy steel dies. Plastic dies have enough strength to rap form today's flat body panels.

Investment Moves Slowly

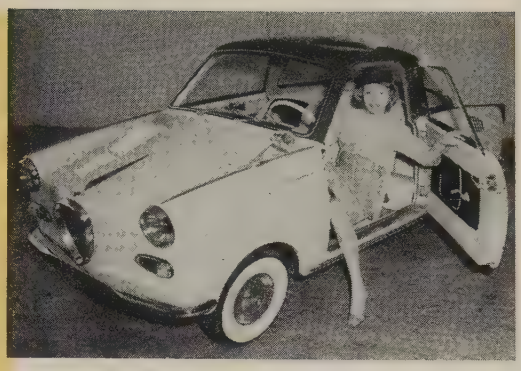
Those advances in technology and methods call for little capital spending this year. Machine tool makers, for example, expect a gradual business upturn this year, but they see no major buying by automakers through 1962.

Car companies are now involved in retooling, rebuilding, and reassigning machine tools. But 1959 will see the start of two advances in this field that will have an impact on motordom's future plans: 1. More numerical controls will be used—even on vertical boring machines. 2. The industry expects to agree on standards for building block components, although no or-

Import Sales

	Units	% of Market
1959†	400,000	7.3
1958*	362,000	8.4
1957	259,000	4.4
1956	108,000	1.9
1955	57,000	0.8

†Projected. *Preliminary.
Automobile Manufacturers Assn.



Miniature imports, like this German Goggomobil, are good conversation pieces, but the main market is in longer wheelbase cars

ders are anticipated before 1960.

• **Planning**—The Department of Commerce says first quarter capital expenditures of the automotive industry will be $119 million, vs. $143 million in 1958's first quarter and $297 million in the first quarter of 1957. Almost all of that money will go into equipment; little will be used for bricks and mortar. It looks like the industry's capital investment will be about $600 million this year, slightly above 1958's preliminary total ($577 million).

When plant construction does start (some contracts will be let in the fourth quarter), it will be mainly for manufacturing rather than for assembly facilities. Assembly plants can produce at least 10 million cars a year, and automakers don't expect such production for some time. One forecast says 1963 will be the next peak year—a possible 7.4 million cars may be produced. In 1965, production may reach 8.5 million. The Ohio Valley and the Southwest will see a further concentration of automotive plants.

Marketing Trends

It seems unlikely that the automobile industry will drop its dealer structure, although there's talk of automotive supermarkets and factory merchandising. Dealers are strong enough to protest any such maneuvers. The companies don't want to see them go because they represent millions of dollars worth of marketing capital.

• **Here's The Trend**—Probably the biggest change coming up will be growth of open lot marketing. Dealer corporations will sell and display cars on several open air lots (like used car pitchmen), but they'll build central service depots to handle maintenance.

Each Firm Has Headaches

Autodom as a whole faces metalworking's big problem of rising labor and material costs. In addition, each company has its own peculiar corporate headache.

The biggest concern to GM in the next few years appears to be how well it can maintain divisional autonomy while it continues to push the use of interchangeable parts to cut down on manufacturing costs. Division chiefs understand the need for standardization, but they tend to resent it because it limits individual accomplishment. But management will go along with the plan. GM's aim is to keep divisions separated—but standardized—so it can avoid Congressional antitrust probes.

Ford Needs Management

After a year of management shakeups and ousters, Ford Motor Co. finds it still lacks middle management people who are capable of taking over top management reins. The building of a strong chain of command this year is important to the company's future.

Detroit is hearing rumors that Ernest R. Breech, chairman, will retire shortly. Talk persists that

Now STATIC POWER Adjustable Speed Packaged Drives

No moving parts . . .

Cutler-Hammer *ULTRAFLEX*® *DRIVES* provide outstanding savings in installation—operation—maintenance

No moving parts! Light, compact static power conversion units have replaced the conventional m-g set. Ultraflex Packaged Drives save up to 50% in valuable floor area . . . up to 75% in weight, permitting rapid, low cost installation or rearrangement of production machinery without special handling equipment or floor loading preparations.

No moving parts! Ultraflex Packaged Drives provide a new high standard of operational efficiency and ultra-responsive speed control. Works perfectly without forced ventilation . . . less power wasted as unwanted heat. No power robbing friction or windage losses.

No moving parts! Simple static power conversion units require only a fraction of the time and effort needed to maintain conventional rotating type drives. With Ultraflex, there are no bearings, commutators, or brushes to service. No shafts to align. No couplings to maintain. No inertia loads to balance. No fans or filter to clean or change.

Ultraflex Packaged Drives come complete with operator's station, static power conversion unit, and heavy duty D-c drive motor. Standard Ultraflex Drives provide an 8:1 speed range with wider ranges available upon request. Optional features include dynamic braking, jogging, reversing, tach-generator speed regulation, etc.

Cutler-Hammer also provides a complete engineering service which will custom-design a static powered adjustable speed drive to meet your specific requirements. Get all the facts today, write on your company letterhead for new bulletins EN64-A213 and EN65-A213
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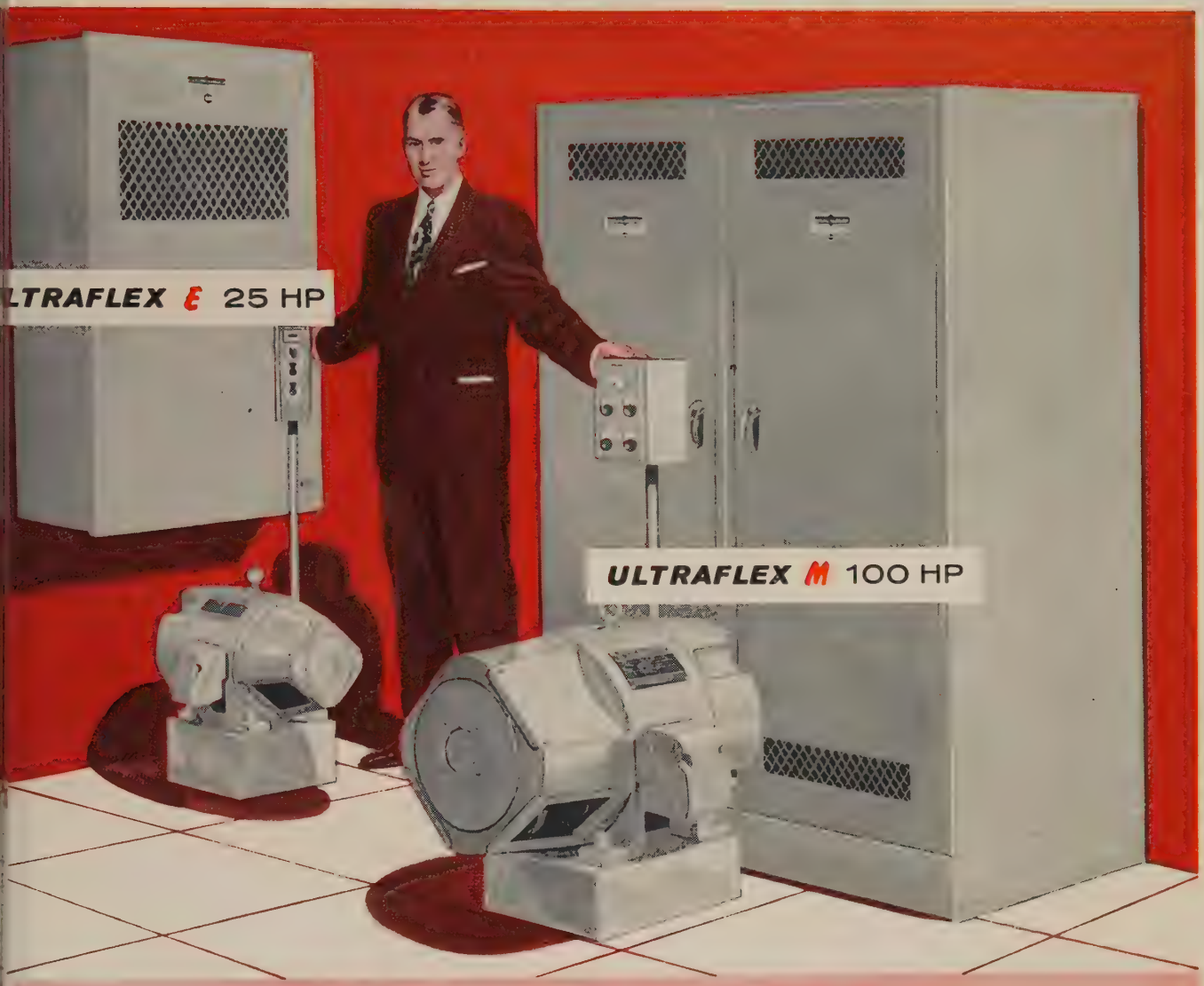
Associates: Canadian Cutler-Hammer, Ltd.; Cutler-Hammer Mexicana, S. A.; Intercontinental Electronics Corporation,



ULTRAFLEX DRIVES Pack More Power per Square Foot . . . More Power per Pound

HP	CONVENTIONAL m-g DRIVES SQ. FT.	CONVENTIONAL m-g DRIVES LBS.	ULTRAFLEX—E SQ. FT.	ULTRAFLEX—E LBS.
5	3.89	543	Wall Mounted	215
7½	3.89	550	Wall Mounted	215
10	5.44	647	Wall Mounted	215
15	7.0	983	Wall Mounted	330
20	9.5	1830	Wall Mounted	330
25	9.5	1990	Wall Mounted	330
30	9.5	2120	6.46	625
40	13.8	2350	6.46	625

HP	CONVENTIONAL m-g DRIVES SQ. FT.	CONVENTIONAL m-g DRIVES LBS.	ULTRAFLEX—M SQ. FT.	ULTRAFLEX—M LBS.
5	3.89	543	3.5	660
7½	3.89	550	3.5	870
10	5.44	647	3.5	870
15	7.0	983	3.5	1000
20	9.5	1830	3.5	1000
25	9.5	1990	4.5	1250
30	9.5	2120	4.5	1250
40	13.8	2350	4.5	1250
50	17.8	2980	11.7	2200
60	23.3	4070	11.7	2200
75	23.3	4800	11.7	2200
100	25.2	5700	11.7	2400

ULTRAFLEX E 1 HP to 40 HP

Electronic Type Adjustable Speed Drives

Ultraflex E is the simplest, most flexible, most dependable electronic adjustable speed drive on the market today. Heavy duty power tubes have replaced all "radio type" components assuring maximum efficiency and maintenance-free operation. Standard features of design include a closed loop voltage feed back system for accurate voltage regulation, current limit control, and static rectifier field excitation. Compact design permits wall mounting of the control units up to 25 HP.

ULTRAFLEX M 1 HP to 200 HP

Magnetic Amplifier Type Adjustable Speed Drives

Ultraflex M Packaged Drives set new standards for ultra-efficient, ultra-responsive operation. Fully 15% more efficient than conventional rotating type drives, the static magnetic amplifier power conversion unit avoids all power losses due to friction, windage and the necessity of transferring power across multiple air gaps as in rotating machinery. Standard Ultraflex M drives are equipped with a closed loop voltage feed back system with IR compensation for accurate voltage regulation, current limit control, and static field excitation.

U. S. Truck Registrations

(Thousands of units)

	Light	Medium	Heavy	Totals
1959†	590,000	125,000	275,000	990,000
1958*	505,000	110,000	205,000	820,000
1957	577,000	141,000	231,000	949,000
1956	561,000	178,000	261,000	1,000,000

†Projected. *Preliminary.
Adapted from *Ward's Automotive Reports.*

The trend in heavy trucks is to diesels with tilt cabs, like this Diamond T with Spicer Presto-matic transmission

Henry Ford II will be named to Mr. Breech's post, and his position as president will be taken by William Clay Ford.

Ford naturally denies this rumor, but there's little doubt in motordom's mind that the company needs strengthening near top levels. This year Chevrolet will outsell Ford by a wide margin despite last quarter gains. Chevy sales through November, 1958, total 1.17 million, against Ford's 999,000 total.

Chrysler Has UAW Trouble

Labor continues to be Chrysler Corp.'s chief irritant. When the last vestiges of the old Briggs Body contract are gone, the company should be in a position to get its work standards on a par with those of the Big Two. Until then, the firm will continue to be plagued by wildcat walkouts.

The company cannot remain in Detroit and be competitive. The UAW now charges that antiquated plants and equipment are causing the higher production demands it's angry about. Its position seems to give Chrysler the opportunity to transfer major operations to Ohio and Indiana, but the union indicates it will fight transfers to protect Detroit jobholders. Chrysler management hints it will continue to decentralize. It believes this will put the UAW on weaker bargaining ground for future battles.

Look for Chrysler to build up its European manufacturing and marketing activities this year. It has never been competitive in the export or foreign market but now plans to take advantage of common market trading.

How's AMC's Health?

George Romney, American Motors Corp. president, is the man of the hour in Detroit. Rambler sales doubled this year. AMC reports a $26 million profit for fiscal 1958. The company is spending $10 million to upgrade manufacturing facilities and boost annual production capacity over 400,000 units. Mr. Romney expects better than 300,000 unit sales this year.

Industry pessimists still wonder how Rambler will do when it's stacked up against Ford and GM economy cars and marketing skills. Unless the firm has guts enough to make drastic changes that will be industry firsts, motordom suspects it still may be in for rough going.

So far, there are few signs that Mr. Romney will take the gamble. The company plans a facelift for 1960. It's looking at an aluminum block engine and a trans-axle, but initial reactions are chilly. AMC's challenge: Get gutsy again!

S-P Fixes Bayonets

Lark shows up well on dealer sales, but there aren't enough registration figures available to tell whether the South Bend automaker's gamble has paid off. Economy cars are the right idea, but the Lark may be a little too late to help Studebaker-Packard Corp. out of its financial hole.

Detroit believes that under the guidance of A. M. Sonnabend, the merger wizard, S-P's name will remain in the corporate directories, but the industry doubts that the firm will continue to produce cars. Rumors that International Harvester Co., Chicago, might take over Lark manufacturing and sales are discounted. S-P has talked about 160,000 sales this year. Unless a boomlet appears, it seems unlikely it can get more than 100,000. Breakeven reportedly is around 120,000 units. The company built about 55,000 cars in 1958.

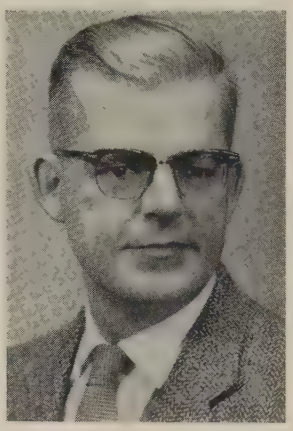
Suppliers Take Heed

Automakers see 1959 as a make-ready year. Integrated designs and standardized parts mean fewer suppliers will be getting contracts for parts, but those who do will find the orders are larger.

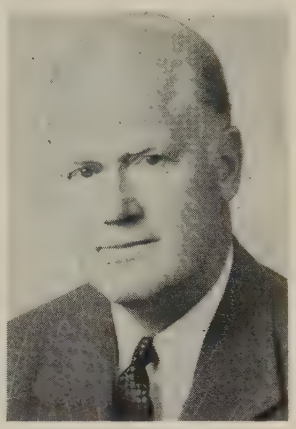
As a vender, you'll want to start thinking along these lines: 1. Look for patentable production techniques that will permit you to integrate several parts into one. (Cold forming is worth investigating.) 2. Develop new product designs that will eliminate expensive tooling and reduce finishing costs. 3. Smaller suppliers must learn to sell service and design knowhow as well as ability to make the product. Plenty of firms have men who can read blueprints. Only a few can come up with new part designs that will cost less to build and work better than their predecessors.

GEORGE L. RYLANDS
Cullman Wheel exec. v. p.

CLYDE E. ROSENE
Surface Combustion p. a.



DR. DONALD G. WILSON
Stromberg-Carlson San Diego



MILTON E. BERGLUND
president of Torrington Co.

George L. Rylands was elected executive vice president, **Cullman Wheel Co.**, Chicago. He was secretary and purchasing agent. **C. Casey** succeeds him as secretary. **Walter R. Whittle** was made assistant to the president, in addition to duties as director of advertising and marketing.

J. H. Carmichael, vice president, **Fairchild Engine & Airplane Corp.**, Hagerstown, Md., was elected president and chief executive officer. He succeeds **Richard S. Boutelle,** who was made vice chairman.

C. R. Welles was elected vice president-sales, **Hanna Furnace Corp.**, merchant pig iron division, Detroit, of National Steel Corp. He replaces **William Kerber,** retired. **Sherman B. Burke** succeeds Mr. Welles as sales manager.

Glenn H. Crocker was made general sales manager, **Roots-Connersville Blower Div.**, Connersville, Ind., Dresser Industries Inc. He replaces **W. W. Harris** who resigned in 1958.

Bernard J. Shallow, former general sales manager, was elected vice president-sales, **Marlin-Rockwell Corp.**, Jamestown, N. Y.

Crawford B. Murton was made sales manager, **Vesuvius Crucible Co.**, Swissvale, Pa. He succeeds **Richard H. Stone,** retired.

R. A. Brown was made director of the new research and development section at United States Steel Corp.'s **Consolidated Western Steel Div.**, Los Angeles, (Mayport plant).

Clyde E. Rosene was made purchasing agent, industrial division, **Surface Combustion Corp.**, Toledo, Ohio. His promotion follows retirement of **Morris Goodman.** Mr. Rosene has been assistant purchasing agent since 1943.

Dr. Donald G. Wilson was appointed general manager of the San Diego, Calif., facility of the electronics division of **Stromberg-Carlson Div.**, General Dynamics Corp. He succeeds **Harold P. Field,** recently named director of marketing, electronics division. Dr. Wilson was in Rochester, N. Y., serving as associate director of research and advanced development.

I. K. MacGregor was appointed vice president-staff operations, **American Metal Climax Inc.**, New York. He was vice president-eastern operations of Climax Molybdenum Co., division.

John S. Collbran Jr. was appointed Pacific district manager at Los Angeles for **New Jersey Zinc Co.**, newly established sales district for the area. He is replaced as western district sales manager, Chicago, by **J. P. Sheridan.**

M. E. Carruthers was named director of stainless steel research for **Armco Steel Corp.**, with headquarters at the central laboratories, Middletown, Ohio. He succeeds **Dr. A. L. Feild,** retired. **F. K. Bloom** was made manager, research laboratory, at the Baltimore Works, a position also formerly held by Dr. Feild. **M. W. Marshall** succeeds Mr. Carruthers as supervising research metallurgist.

Milton E. Berglund was elected president, **Torrington Co.**, Torrington, Conn. He succeeds **Walter C. Thompson,** who was elected chairman. **Rodney T. Dunlap** was elected executive vice president. Mr. Berglund has been executive vice president since 1955. Mr. Dunlap was elected a vice president in 1957. He transferred last August to Torrington from the Bantam Bearings Div., South Bend, Ind., where he served as vice president and general manager.

Robert E. Lewis was elected president, **Sylvania Electric Products Inc.**, New York. Formerly a senior vice president, he succeeds **Don G. Mitchell,** who continues as chairman.

John L. Tullis succeeds **J. Pat Beaird,** resigned, as president and general manager of **J. B. Beaird Co.**, Shreveport, La., subsidiary of American Machine & Foundry Co. Mr. Tullis was executive vice president. Mr. Beaird had served as president since 1939. He will devote full time to a number of other interests.

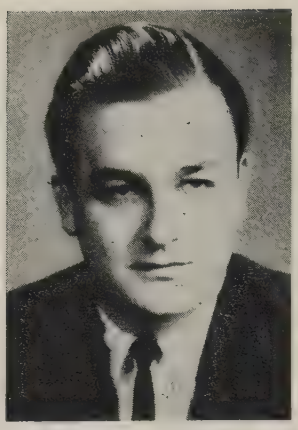
Anthony B. Coburn was made production control manager by **Titeflex Inc.**, Springfield, Mass., subsidiary of Atlas Corp. He was production control manager, industrial hardware plant, Stanley Works.

Edward V. O'Neil, general manager of **Donner-Hanna Coke Corp.**, Buffalo, was elected vice president. He succeeds **Philip S. Savage,** retired.

Edward N. Fleming joined **Green River Steel Corp.**, Owensboro, Ky., as superintendent of maintenance. He was assistant to the executive

DONALD A. GAUDION — MERCER BRUGLER

Pfaudler Permutit president and chairman



THOMAS A. FRIBLEY — ROBERT E. THOMAS

Cleveland Cap Screw executive posts

vice president, H. H. Robertson Co.

Donald A. Gaudion was elected president of **Pfaudler Permutit Inc.**, Rochester, N. Y. He succeeds **Mercer Brugler** who was elected chairman. Mr. Brugler continues as chairman of the executive committee. Mr. Gaudion was executive vice president. **H. W. Foulds** has retired. He had been president of Permutit Co. since 1944, and upon its recent merger into Pfaudler Permutit Inc., was made chairman. **C. Wendell Beck** was made general manager of the Pfaudler Div., succeeding Mr. Gaudion, who has been acting in that capacity.

Edward F. Schweich was named executive vice president, **Lewin-Mathes Co.**, division of Cerro de Pasco Corp., St. Louis. He was secretary. **Harold E. Lewin** was made vice president in charge of metal purchasing; **Bram J. Lewin**, vice president-production; **Roderick J. Lewin**, vice president-sales. **James M. Dreyer** was named secretary; **Jerome J. Marx**, general sales manager; **Henry Stucke**, assistant general sales manager.

Westinghouse Air Brake Co. relocated purchasing departments serving the Pittsburgh divisions, and named **R. E. Moritz** manager of purchases, Air Brake and Industrial Products Divisions, with headquarters in Wilmerding, Pa.; and **H. I. McKeever** manager of purchases for the Union Switch & Signal Div. at Swissvale, Pa. **R. M. Hornbeck**, vice president-purchases and traffic, will supervise and co-ordinate all purchasing, traffic, and transportation activities from Pittsburgh headquarters.

Robert W. Sheehan was made plant superintendent; **Frank O'Connor**, chief of research, development and material control at Du-Co Ceramics Co., Saxonburg, Pa. Prior to joining Du-Co in 1956, Mr. Sheehan was a design engineer at the Radio Corp. of America plant at Findley, Ohio. Mr. O'Connor was laboratory chief for Trenton Potteries, Trenton, N. J.

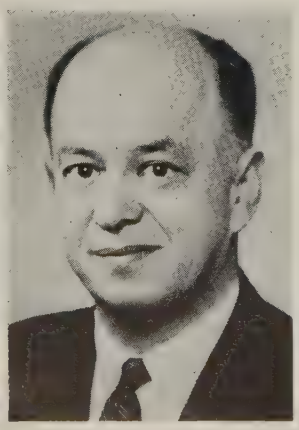
Thomas A. Fribley was elected executive vice president, **Cleveland Cap Screw Co.**, Cleveland. He continues as secretary. **Robert E. Thomas**, general sales manager, was named vice president-sales.

Fischer & Porter Co., Hatboro, Pa., appointed **Frank P. Houpt** manager of its new systems application engineering department.

Oren W. Thompson was made chief engineer, **W. O. Barnes Co. Inc.**, Detroit.

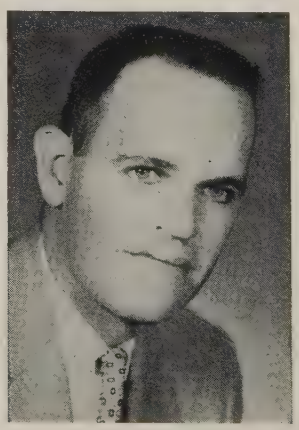
Chrysler Corp., marine and industrial engine division, Detroit, appointed: **Bruce B. Spratling**, product sales manager; **M. J. Yost**, manager of field operations; **William M. Vollendorf**, advertising and sales promotion manager; **Robert C. Loman**, manager of parts and service.

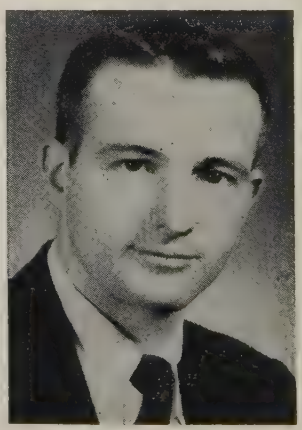
J. Arnold Matthews was named assistant district sales manager, Birm-



EDWARD F. SCHWEICH — HAROLD E. LEWIN

Lewin-Mathes staff appointments

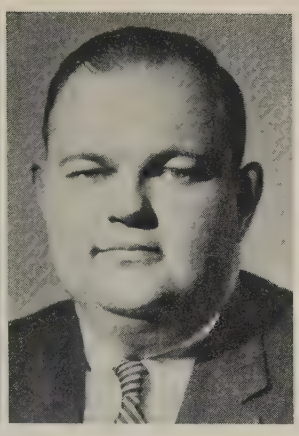




ROBERT W. SHEEHAN — FRANK O'CONNOR

Du-Co plant supt. and research head

YASH SNIDER
heads Hodag tech services



THOMAS D. BURLEY
Carpenter Steel sales post

DR. GERARD E. CLAUSSEN
Arcrods research director

ingham, for **Republic Steel Corp.**

Yash Snider, a research chemist, heads the newly formed technical services department of **Hodag Chemical Corp.,** Chicago. Hodag formulates and produces antifoam agents and surface active chemicals.

Frank U. Hayes resigned as vice president and assistant general manger, **Bullard Co.,** to assume new duties in January as president and general manager of Sperry Products Inc., Danbury, Conn.

Robert D. Teece was promoted from executive engineer to assistant to the executive vice president at **Harnischfeger Corp.,** Milwaukee. **Robert E. Meyer,** chief engineer, large excavator division, succeeds Mr. Teece. **Karl Schneider** succeeds Mr. Meyer.

Clifford W. Bishop was appointed manager of **Consolidated Electrodynamics Corp.'s** southwestern regional sales office in Dallas. He succeeds **Henry S. Black,** recently named director of CEC's DataTape Div. **James P. LaBarber** was made manager, New York district office.

Dr. A. L. Antonio returned to **Aerojet-General Corp.,** Azusa, Calif., as vice president-chemical division. He directed Aerojet's solid propellent research and development between 1944 and 1954. He has since been general manager, Chemical Div., General Tire & Rubber Co., parent firm.

Edgar J. Griesbaum was made sales manager, tubular products, **Laclede Steel Co.,** St. Louis. He succeeds **E. J. Winer,** retired.

Thomas D. Burley was named to the new post of manager of high temperature steel sales for **Carpenter Steel Co.,** Reading, Pa. He was sales representative, Pittsburgh office.

American Bridge Div., U. S. Steel Corp., named as regional contracting managers: **J. H. Long,** eastern area, New York; **D. J. Morfee,** central area, Pittsburgh; **P. J. Larson,** midwest area, Chicago; **Walter Schielke,** southern area, Houston; **J. C. Hamilton,** western area, Los Angeles.

J. A. McIlnay was elected to the new post of vice president-marketing, **Electric Storage Battery Co.,** Philadelphia. **Owen R. Slauson,** former general sales manager, succeeds Mr. McIlnay as vice president-domestic sales for **Ray-O-Vac Co.,** division at Madison, Wis. **C. J. Moore,** former sales manager, fills the new post of general sales and marketing manager, **Exide Industrial Div.,** Philadelphia.

Dr. Gerard E. Claussen was made director of research and welding engineering for **Arcrods Corp.,** Sparrows Point, Md. He formerly served as a metallurgist for Machlett Laboratories, Reid-Avery Co., and Union Carbide & Carbon Corp. (now Union Carbide Corp.).

George A. Dornin Jr. was appointed manager of ingot mold sales, **Shenango Furnace Co.** He is in the Sharpsville, Pa., office.

George Costello joined **Servo Corp. of America,** New Hyde Park, N. Y., as sales engineer in the government contracts department. He was New York district sales manager for Vickers Electric Products Div., Sperry Rand Corp.

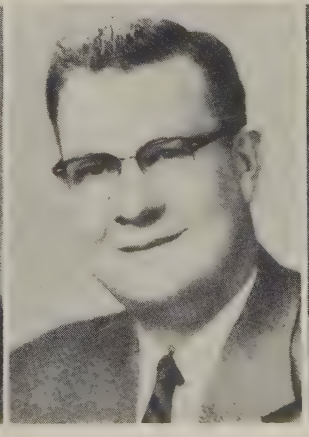
G. B. Price was made executive assistant to the general manager, **Ford Div.,** Ford Motor Co., Dearborn, Mich. He is also in charge of the organization and systems department, and the administrative services department. Mr. Price was manufacturing planning manager.

Kuno H. Doerr Jr. was elected president, **Southern Peru Copper Corp.,** succeeding **Edward McL. Tittmann,** who was elected chairman and chief executive officer. Mr. Doerr will have offices in Lima, Peru, where Mr. Tittmann was stationed. Mr. Tittmann will be in New York. Southern Peru Copper is a joint venture of four American mining companies.

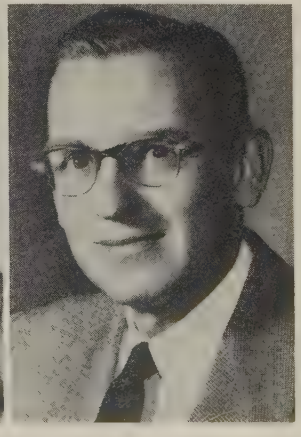
Daniel W. Schluter fills the new post of manager-advertising and

(*Please turn to Page* 136)

J. A. McILNAY



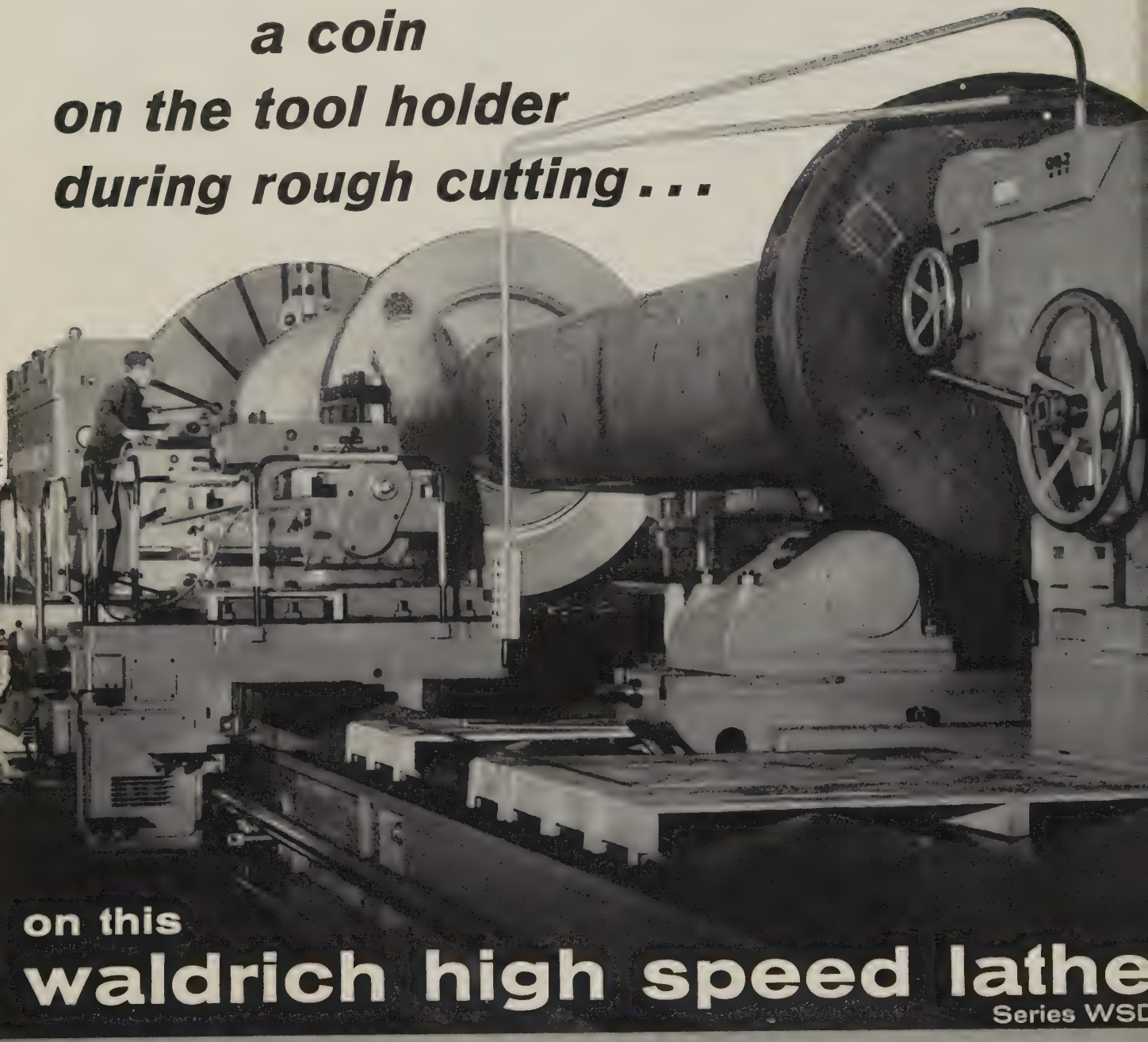
OWEN R. SLAUSON



C. J. MOORE

heads marketing and sales for Electric Storage Battery and divisions

you can balance a coin on the tool holder during rough cutting . . .



on this waldrich high speed lathe

Series WSD

- Rigid construction insures vibration-free operation with carbide tools.
- Maximum utilization of horsepower in main drive
- Rugged headstock
- Heavy duty tail stock
- 3-way and 4-way bed design
- Fast, efficient chip collecting

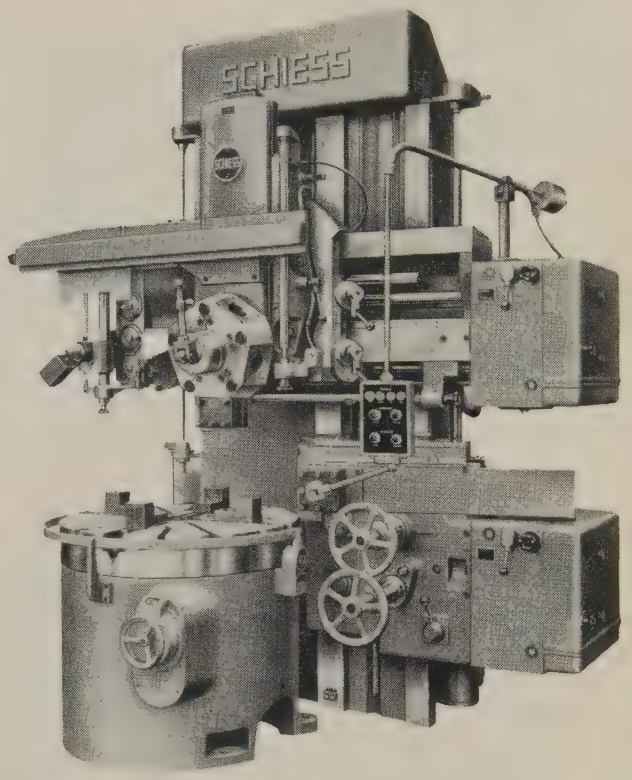
Write for details today.

WALDRICH SIEGEN

american waldrich mfg. corp.

1232 PENN AVENUE, PITTSBURGH 22, PENNSYLVANI

Model KE Single Column Vertical Turret Lathes with 40″, 50″ and 65″ turning diameters for high-speed carbide machining.



Hydraulic pre-selection of speeds set by handwheel and read on illuminated dial. 16 spindle speeds—ratio 1:50—up to 310 rpm for carbide machining on Model KE 100. Table runs on tapered roller bearings.

Fingertip control for direction of feed and rapid traverse with spring-loaded mono-levers for normal direction plus angular compound feeds. Mono-levers move in same direction as desired feed or traverse movement, simplify correct setting by operator. Specially designed electro-magnetic disc clutches disengage feed instantly with no over-riding or coasting.

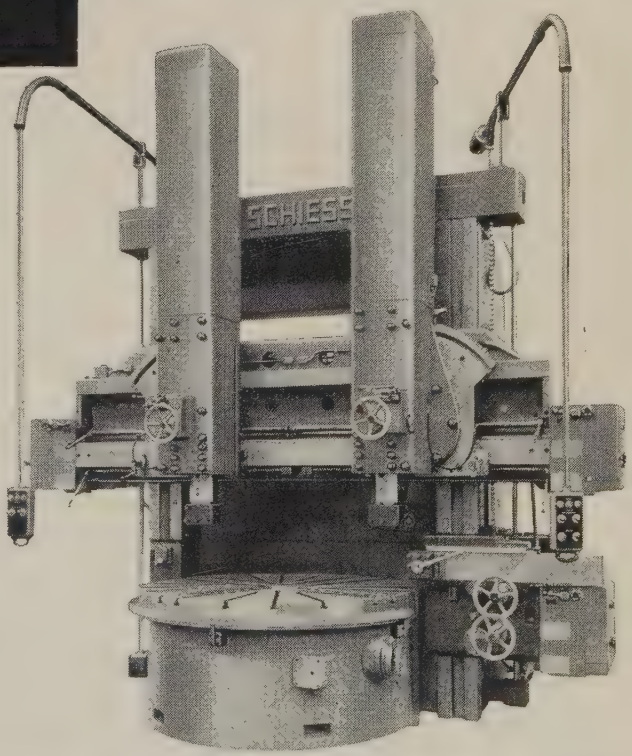
Counterbalanced cross rail and side head. Single lever unlocks, raises or lowers, and locks cross rail simultaneously by electro-mechanical controls. *No bolts or nuts to loosen or tighten by hand.*

Slip ring motor provides smooth "load sensitive" acceleration and braking. Variable speed as well as constant cutting speed available. Motor mounted on left side of machine with separate control enclosure. Fingertip control assured by pendant mounting of all necessary control functions. Electrics supplied from all U. S. manufacturers.

Copying attachment with electric tracer for use on cross rail or side head.

ee why tool engineers call these heavy producers, 'MOST MODERN MACHINES OF THEIR TYPE"

Model KZ Double Column Vertical Boring Mills with 65″, 80″, 98″ and 118″ turning diameters.



All operating features of KE Series Vertical Turret Lathes are combined in

SCHIESS KZ DOUBLE COLUMN VERTICAL BORING MILLS, PLUS—

Heads equipped with steel octagon rams can be swiveled—have automatic feed in vertical, horizontal and angular direction and are independent of one another as to amounts and direction of feed. Table, feed and rapid traverse controls are all contained in the pendant station. Standard model KZ Double Column Vertical Boring Mills are available with 65″, 80″, 98″ and 118″ turning diameters.

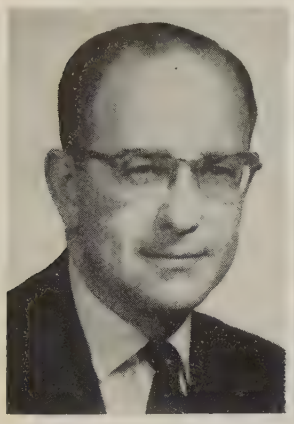
Get to know these products of Europe's largest builder of heavy machine tools. Parts and service are as close as Pittsburgh. An American Schiess engineer will be ready to help you size up these heavy producers for your heavy production needs. Write for catalogs and complete specifications on these and other Schiess equipment.

SCHIESS

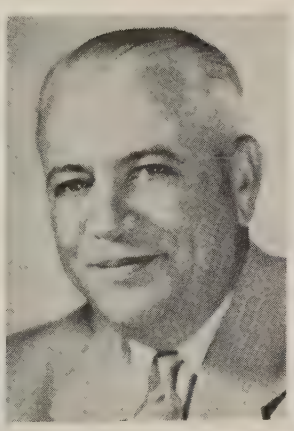
AMERICAN SCHIESS CORPORATION

1232 Penn Avenue, Pittsburgh 22, Pa.

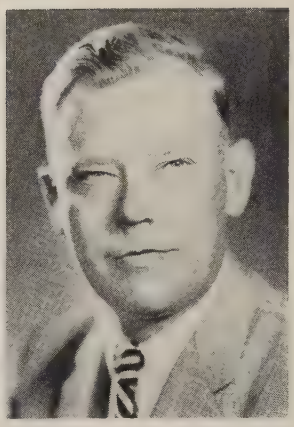
MEN OF INDUSTRY



ALLISTAIR DUNN
Ohio Injector mfg.-dir.



CHARLES E. BEAVER
joins Buell Engineering



O. VICTOR PETERSON
Alcoa International post

R. J. WEBB
Marshall & Huschart v. p.

WILLIAM H. HARMAN JR.
I-T-E Circuit Breaker post

WILLIAM H. BENTON JR.
Anaconda Wire & Cable post

market research, **Tubular Rivet & Stud Co.**, Quincy, Mass. He was eastern district sales manager.

R. J. Webb was elected a vice president of **Marshall & Huschart Machinery Co.**, Chicago. He has been with the company for more than 20 years.

William H. Harman Jr. was named a product sales manager in the transformer and rectifier division, **I-T-E Circuit Breaker Co.**, Philadelphia. He is responsible for sales of transformers and Tranfo-Unit packaged substations. Mr. Harman was a sales engineer in the small air circuit breaker division.

Glidden Co., Cleveland, elected **Dr. William von Fischer** vice president-research; **James W. Pollard**, vice president-engineering.

Carel H. Neffenger was promoted to general sales manager, **G. S. Equipment Co.**, Cleveland, and affiliates.

William H. Benton Jr. was made general manager of mills, **Anaconda Wire & Cable Co.**, New York, subsidiary of Anaconda Co. He was manager of the company's Marion, Ind., mill from 1951 until 1957, when he was made assistant vice president-manufacturing, with headquarters in Hastings-on-Hudson, N. Y. **William L. Grey** fills the new post of vice president-general counsel for Anaconda Wire.

Carl E. Ingels was promoted to manager of manufacturing, **Atkins Saw Div.**, Indianapolis, Borg-Warner Corp. He was production and material control manager.

Dr. Kun Li, senior research engineer, research division, at the Graham Laboratory of **Jones & Laughlin Steel Corp.**, Pittsburgh, was promoted to research associate for the corporation.

William H. Mackey was made merchandising manager of **Martin Steel Corp.**, Mansfield, Ohio, a new post.

Allistair Dunn was named to head manufacturing operations for **Ohio Injector Co.**, Wadsworth, Ohio, as director of manufacturing, under a newly aligned production organization grouping. Mr. Dunn held a similar post with Blackhawk Mfg. Co. **Verland W. Belt**, plant superintendent at Wadsworth facilities, was named manager of Ohio Products Co., Orrville, Ohio, a subsidiary. Named to newly created posts for Ohio Injector are **John T. Lesko** as manager, manufacturing engineering; **Malcolm K. Sheppard Jr.** as manager, industrial engineering.

Charles E. Beaver joined **Buell Engineering Co. Inc.**, New York, in a sales and marketing capacity. He was vice president-sales, Research Cottrell Inc., subsidiary of Research Corp.

O. Victor Peterson, former chief industrial engineer for the smelting division, **Aluminum Co. of America**, Pittsburgh, was named manager of operations of **Alcoa International Inc.**, subsidiary. **Kenneth H. Hawkes** was elected treasurer of the subsidiary. **R. Kenneth Smith** was made assistant manager; **George V. B. Day**, chief analyst in Alcoa's commercial research division, Pittsburgh.

Charles R. Allen joined the staff of **D. K. MacLennan Co.**, Los Angeles, as technical representative for Misco Precision Casting Co., Whitehall, Mich.; and for Casting Engineers Inc., Chicago.

Bethlehem Pacific Coast Steel Corp appointed department superintendents at its Seattle steel plant: **J. H McKie** is labor and transportation superintendent; **T. J. Whinihan** roll shop superintendent; **J. P Dana**, superintendent of orders.

William J. Marcellus was named manager of the export division of **Fairbanks, Morse & Co.**, Chicago. He takes over duties of **John A. Cuneo**, vice president-export sales, who retired.

Burton T. Kehoe was named sales manager, packaged air conditioning equipment, **Unitary Equipment Div.**, Carrier Corp., Syracuse, N. Y. **Arthur E. Meling** was made manager of the division's technical services.

This year's technological developments will play a vital role in the expanded economy of the "soaring sixties." To help you plan for the new decade, STEEL asked 285 authorities in metalworking and related fields to tell you what's coming and how you will benefit. Their comments are in 15 categories, indexed below by page number:

1959 FORUM ON TECHNICAL PROGRESS

HIGHLIGHTS

STEELMAKING— Authorities are enthusiastic about oxygen, basic open hearths, and increased sinter burdens. But there's an interesting undertone: Can we justify the traditional blast furnace-open hearth combination? Some feel that steel would do better costwise by concentrating on other methods like direct reduction, beneficiation, and electrics. One comment (J. Byron Jones, Page 363) says ultrasonic energy applied to a molten bath can produce hot strip coatings of better quality at less cost.

NONFERROUS METAL PRODUCTION— Producers and fabricators of nonferrous metals see 1959 as a good year. Greater production capacity and technological developments point to increased uses for the metals. Aluminum consumption should approach 4 million tons. New high temperature alloys and lower prices will aid the growth of titanium. Continuous casting will improve brass mill goods.

CASTING— Higher mechanical properties across the board—this is the nearly universal goal for casting development. Added to it: Closer tolerances, thinner sections, and better surface finishes. Vacuum diecasting is a favorite to pay off commercially. Shell molding, air-set cores, and CO_2 molds and cores will blossom. Both investment and plastic-mold casting methods are on close-tolerance jobs. Aluminum-silicon alloys are being considered for the diecast aluminum engine blocks.

MATERIALS AND METALLURGY—Metallurgists are concentrating on materials to meet the requirements of the rapidly advancing Space Age. The high melting point, refractory metals are getting most of their attention. Vacuum melting has become firmly established as a technique for upgrading ordinary steels are well as the superalloys. But it still has phenomenal growth potential. The metallurgical developments of the next decade promise to all but obscure what has gone before.

HEAT TREATING— The advent of the Space Age has had repercussions in heat treating, too. Furnace builders are designing units for higher temperatures and automatic operation. More use of atmospheres is predicted. Static devices will get more play in heat treat control, particularly with induction units. A new instantaneous heat system, called Luminous Wall, may find more uses this year.

INSPECTION AND TESTING— These will be the inspection and testing newsmakers during the coming year, say our authorities: Microhardness devices will check and sort workpieces; more steel mills will use Magnaglo magnetic particle devices to find flaws in billets and products. Units that will prepare plant production data in 15 minutes are on the way.

DRIVES AND CONTROLS—Automatic operation still heads the list of developments in industrial drives and controls. You'll see more use of static power and control units, more digital programming equipment, and greater use of data logging gear. Better generators and adjustable speed drives are coming. New insulating material will widen the usefulness of electric motors.

MACHINING— Automation continues as the bright star of machining development—future work will be aimed at greater versatility so automation will fit more production lines. Building-block standards, for example, should get underway this year. Further work on numerical con-

trol should help cut equipment costs and simplify the sometimes tedious job of programming. The experts also talk about the need for radically new machining techniques to handle the tough metals—and there's need for refinements on newcomers like chemical milling, ultrasonics, and electromachining.

TOOLING AND GAGING— Ceramic cutting tools should move into the areas of heavier cuts on high strength steels and cast iron and finishing of steels harder than Rc 55. Throwaway cutting tools continue to take on new jobs. Look for gaging to move to finer tolerances—and watch for tape controlled gaging. Plastics, alloyed with metal powders or fibers for better wear resistance and stability, are in the offing.

FORMING— Explosive forming methods dominate the news. With at least one machine in production and several job shops in operation, you can expect dozens of new applications in the near future, the experts tell us. An ultrasonic manufacturer (Page 363) says drawing, extrusion, pressing, and similar squeeze forming can be done more easily with ultrasonic vibration.

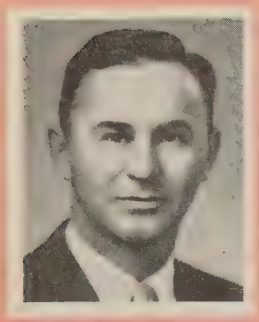
CLEANING AND FINISHING—Thicker, crack-free chromium plating is on the way. Demand for finished aluminum is spurring development on both surface preparation and finishing. Look for further integration of cleaning and finishing lines—for example, vapor degreasing and metal finishing integration can cut costs 50 per cent. Ultrasonic cleaning will continue to gain—a solution for cavitation effects may come this year.

JOINING AND ASSEMBLY— Ultrasonic welding is coming of age. It will be kept in the spotlight because it's beginning to handle gages somewhat heavier than foils. Welding with explosives will gain some attention for applications like liners for pipes handling corrosive liquors. High frequency resistance welding will attract many whose products require a narrow heat-affected zone.

HANDLING & PACKAGING— Power tools will be used more in the handling and packaging of materials this year and in the next decade. Better rust preventives will protect ferrous metal parts, in process or packaged for shipment. More extensive use of automatic cranes and conveyors will stimulate the continuous flow of goods, from raw materials to finished products, on more efficient production lines.

LUBRICATION— Refractory and reactive metals will be used more this year and in the decade to follow. There will be greater demand for rolling, machining, and operating lubricants that are resistant to heat and fire. More interest will be shown in lubricants that permit rolling and machining at lower temperatures and higher speeds, at the same time preventing rust and scale formation.

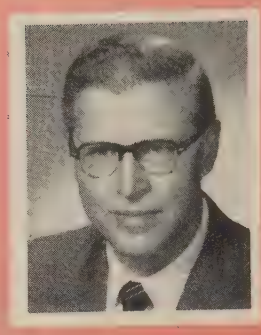
SERVICE & MAINTENANCE— This year, cathodic or electrical protection systems will find wider use in preserving metal that is under ground or under water. Also, there will be better protective coatings—some that are applied hot, and others that are applied cold and allowed to set chemically. In the field of water treatment, new coagulants will do a better job of clarifying the water flowing to and from industrial plants. More attention will be given the recovery of valuable chemicals, such as the pickling liquor from steel mills.



W. R. LYSOBEY
Technical Service Manager
Air Reduction Sales Co., a division of
Air Reduction Co. Inc., New York

JOHN K. STEWART
Manager, Steel Mill Sales Div.
Air Products Inc., Allentown, Pa.

R. E. BIRCH
Director of Research, Harbison-
Walker Refractories Co., Pittsburgh



FRANK M. CASHIN
Vice President, General Manager
Kaiser Chemicals Div., Kaiser
Aluminum & Chemical Corp.
Oakland, Calif.

1959 FORUM ON TECHNICAL PROGRESS

Steelmaking

Solid Material Injection Slated for Wider Use

—W. R. LYSOBEY

• We look for ever increasing quantities of oxygen to be used in steelmaking operations. In roof lance operations, use of flame enrichment and top blown converters will increase. The growth curve for the consumption of oxygen per ton of steel shows no evidence of leveling off.

Injection of solid material into molten metal will continue to become more widespread. The technique was originally developed for desulfurizing pig iron with calcium carbide. Similar techniques are being employed for carburizing steel in open hearth and electric furnaces.

Expect to see the injection of reactive metals, reactive alloys, flux materials, and degasifiers.

Oxygen Technology Extends Usefulness of Open Hearth

—JOHN K. STEWART

• One of the great advances in steel will come during the next year or so: More widespread adoption of oxygen steelmaking—including the oxygen converter and, even more important, the American improvement, roof jet oxygen and combustion oxygen in open hearths.

With advances that our operators have made, it will be a long time before the open hearth is displaced. Oxygen use is limited to some extent by roof life. In some shops its usage is limited by charging, tapping, and teeming facilities. It will not be uncommon to see open hearth furnaces doubling production that was common five years ago.

We look for oxygen plants at almost every mill. It is a cheap bulk commodity as available as electric power, water, and fuel gas.

Direct ore reduction will continue to get attention. A new process provides a molten hot metal rather than cold synthetic scrap. It makes iron that is suitable for further refining in an oxygen converter.

Basic Open Hearth Roof Is Making Big Advances

—R. E. BIRCH

• Great progress was made in the basic open hearth roof in 1958. More than 70 are in service now. Of those yet to be built, about 12 will be fully suspended. The rest will be of sprung arch construction with positive hold-downs and various methods of suspension.

Basic roofs installed last year will not be completed until April this year. By then practical answers to many theoretical questions will be found. The relative merits of chemically bonded magnesite-chrome and chrome-magnesite brick, both with internal plates, will be more clearly seen. Hard fired magnesite-chrome brick (reportedly favored by European operators) and metal cased magnesia-spinal brick will also have been evaluated.

Higher furnace temperatures and increased oxygen use are permitted by basic roofs with resulting longer furnace campaigns.

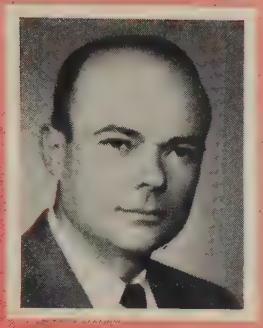
All Basic Open Hearth To Boost Basic Refractories

—FRANK M. CASHIN

• The all basic open hearth, the basic oxygen process, and the production of higher purity steels pose real challenges to the basic refractory industry.

Because of the greater strength of basic refractories, it is feasible to use sprung roof construction for open hearths with either burned or unburned brick. We feel that 1959 will see considerable work done to develop a brick with greater resistance to iron oxides. Results so far are promising.

As the conversion to the all basic open hearth gets into full swing, we think the basic refractory market may increase 25 per cent. To meet the demand, re-



W. E. MILLER
Manager, Metal Rolling & Processing Eng., General Electric Co. Schenectady, N. Y.

C. R. AUSTIN
Manager, Steel Plant Development Kaiser Engineers Div. Henry J. Kaiser Co., Oakland, Calif.

HARRY W. McQUAID
Consultant
Cleveland

RUFUS EASTON
Manager, Continuous Casting Section Engineering & Construction Div. Koppers Co. Inc., Pittsburgh

ractory producers are enlarging their apacities.

Some experts expect that by 1965, the asic oxygen process will represent only 0 per cent of productive capacity. We lon't see the same degree of improvement here as in the open hearth.

We have developed a hydration resistant, tar bonded dolomite brick which an be safely stored for some time. t permits centralized production facilties.

The trend toward the production of igher purity steels in vacuum and air nduction furnaces demands purer refractories—those with higher magnesia ontent.

More Automation To Correlate Automatic Feedback Control

—W. E. MILLER

• A "Ring of the Future" (closed loop utomation) promises to be the next great otentiality of automation. It will provide tighter management control of proess performance. Gains will come not in moving the worker farther from the proess, but in putting management closer. Longer runs at best theoretical efficiency nd minimum raw material utilization with output of acceptable quality are assignments now delegated to process supervisors who too often are using incomplete nformation.

The modern control by automatic feedack is common today. The closed loop s frequently the symbol of automation. Many metal rolling processes are just a omplex string of regulating system loops with all control points manually preelected. So much dependence is placed on human intelligence for control input or data taking that such processes cannot e called fully automated.

Progress toward higher levels of automaticity is being made through the applieation of new data processing techniques for serving the functions of data logging, computing, and programming. When enough can be learned of a process to connect proper logged information to a computer which has been instructed to perform proper operations on the data, the computer will be used to reprogram the process and close the outside loop.

One-Third of Our Steel Is Made by Oxygen Process

—C. R. AUSTIN

• At least one more L-D (oxygen) plant should come into production during 1959 and we believe several more will be initiated (two were started last year). In spite of slackened steel production, we are looking forward to an L-D output over 1 million tons in the U. S. This year should see production in the U. S. of nearly 3 million ingot tons.

Overseas, L-D growth has been more spectacular: Five million tons in 1958 (estimated).

The first installations emphasized low-carbon rimmed steel. Today's products include semikilled and killed steel of every carbon range and many low-alloy steels usually made in an open hearth. One German plant is making over 50 per cent of hot-topped steel. Another emphasizes the alloy grades. Several plants produce silicon steel for electrical sheets.

Specifications permitting the use of L-D steels in major product classifications reflect modern trends. The American Society for Testing Materials just printed about a dozen new ones.

Size of L-D heats is going up: Every day, 92 charge-ton heats are being made. Blowing times are 22 to 23 minutes. This year may see even that extended.

Blast Furnace Practices Are Being Evaluated

—HARRY W. McQUAID

• This will be a year of definite change in steelmaking thinking. The blast furnace-open hearth combination has finally become extremely difficult to justify as an economical method of producing tonnage grades of ingots.

Look for the trend in quick delivery orders to be away from the large open hearth to the electric furnace.

At the same time, any important increase in electric arc furnace capacity will result in a sharp increase in scrap demand and prices.

The trends lend impetus to the desire of every important steel producer to eventually replace the blast furnace with some sort of direct reduction. Serious work is being done in that field although most of it is built around the electric arc furnace.

Some relatively low cost programs will have to be reduced to practice or the whole economic future of the steel production plant looks uncertain.

The external treatment of blast furnace hot metal is quite desirable. The day will soon come when blast furnace production from present day equipment reaches its limit. No completely new blast furnace could be economically justified, so external treatment of hot metal, such as the rotary reactor, will have to be introduced soon.

Such an operation of the blast furnace with no concern about sulfur, silicon, phosphorus, or carbon should be a highly important contribution to our national production of iron and steel.

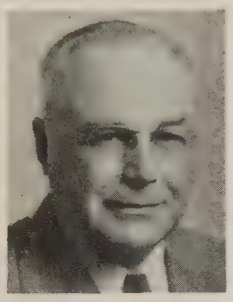
Maps Six Growth Areas For Direct Reduction

—RUFUS EASTON

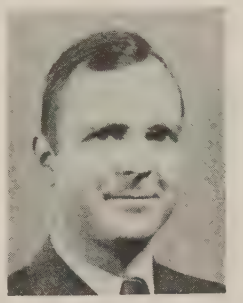
• Direct reduction methods have enormous potential. Prototype plant operations last year showed their commercial attractiveness in many areas. Within the next two or three years, you may see new plants of these types:

Direct reduction plants using low cost ores and coals not suitable for the blast furnace. They will produce low carbon hot metal or pig for electric furnace

Steelmaking

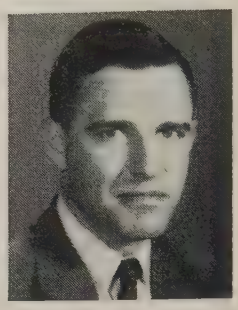


PHILIP S. SAVAGE
Vice President, Donner-Hanna Coke Corp., Buffalo



DR. BRUCE S. OLD
Vice President, Arthur D. Little Inc. Cambridge, Mass.

WALTER M. PATTERSON
Electric Melting Consultant Allegheny Ludlum Steel Corp. Brackenridge, Pa.



T. J. MILHAUPT
Manager, Bulk Gas Sales Linde Co., a division of Union Carbide Corp., New York

steelmaking, or high carbon hot metal for oxygen steelmaking.

Direct reduction plants using the fines and flue dusts now handled by sintering machine and blast furnace.

Reduction plants which process complex ores into their component metallic elements. For example, an ore containing iron, nickel, and chromium can be processed into carbon steel, ferrochrome, and ferronickel.

Direct reduction plants supplying iron for foundry use.

Direct reduction plants processing ores into low carbon hot metal of low tramp element content for use in electric furnace manufacture of high quality steels.

Fully integrated plants with an annual capacity as low as 60,000 tons, based on local ore supplies. They will use direct reduction, electric steelmaking, continuous casting, and small finishing mills to make products such as reinforcing bars and small structurals.

Steel Will Emphasize Coke Quality, Ignore Chemicals

—PHILIP S. SAVAGE

• It is strange that in this chemical age, more thought and research has been devoted to producing coke with a minimum rather than a maximum of byproducts. I believe the trend will continue through 1959.

Unfortunately, it is economically sound, because coal, chemicals from petroleum, and imports principally from the Iron Curtain countries, have forced prices of most coal chemicals so low that it often does not pay to recover them.

The visits of our technical men to the USSR have accelerated the trend already started toward greater beneficiation of blast furnace materials. As a result, much more thought will be given to making better coke than in producing chemicals.

Coke practice has already been greatly improved at many blast furnace plants, and the trend will be to make better coke rather than more of it by using better coals and more skillful blending. I believe manufacturers will find a good market for coal handling and washing equipment that will meet this need.

Since the end of the war, we have seen three new beehive coke plants which recover no gas or chemicals. All coke oven designers are working on means to destroy ammonia in the gas rather than recovering it. I believe that it is sound to build coke ovens that recover only gas and tar, and that 1959 will see ovens of this type built. They should be simple and rugged, with a capital cost much less than that of the chemical type with complete recovery equipment.

Steelmakers Are Stepping Up Their Research Efforts

—DR. BRUCE S. OLD

• Steelmakers are putting increasing emphasis on research. Almost every major company has either expanded its research efforts or has plans to do so.

Such moves are timely. We face rising costs and increasing competition from other metals and materials. The competition is a direct result of research and development in other industries.

The most important new ingredient is greater emphasis on basic research.

Adequate Nickel Supplies To Spur Use of Stainless

—WALTER M. PATTERSON

• Missilemakers demand more exotic steels and alloys.

In general, electric furnace operators have met the challenge, but we are now confronted by requirements for newer, cleaner steels and alloys for use in outer space.

We also find that suppliers of ferroalloys, nickel, cobalt, and other metals are going all out to assist operators. New manufacturers have come into the field. We even find new ferroalloy sections in some melting organizations where members can discuss mutual problems and study processes.

The continuing increased use of oxygen in stainless melting is of tremendous importance to the electric furnace operator. Through its use, the term "charge chrome" has become quite a common designation. Many grades of such material are being made.

Nickel has again become plentiful, creating a free market which could limit the price of 18-8 scrap. Adequate nickel supply will increase the use of stainless in its many domestic, construction, and industrial applications.

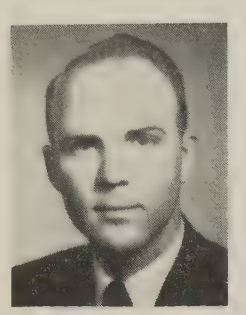
Use of Oxygen in Steelmaking Growing at 2½% Annual Rate

—T. J. MILHAUPT

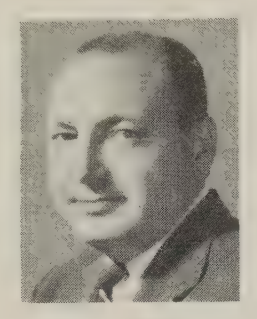
• Industry-wide estimates indicate that oxygen use in steel production is growing at the rate of about 2½ per cent per year. We expect the increase of oxygen use by Linde customers will be much more marked. Translating growth into cubic feet, we feel that by 1964 our customer average will be about 600 cu ft for each ton of steel produced. Contributing factors will be oxygen addition to existing processes, as well as production from new pneumatic facilities.

Whether oxygen use is part of a new process or added to economize, the common denominator is intermittent operation. Top blowing is not done continuously. Oxygen requirements for steel conditioning rise and fall as the scarfing machines are put on or taken off the

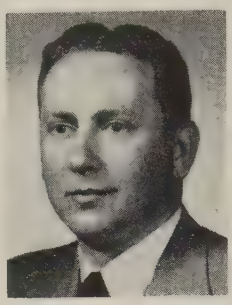
Steelmaking



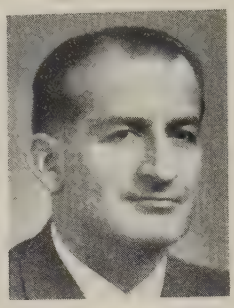
PHILIP J. BERG
Manager, Engineering & Construction Sales Dept.
Dravo Corp., Pittsburgh



F. B. O'MARA
Marketing Manager, Electrode Products
National Carbon Co., a division of Union Carbide Corp., New York



GEORGE E. KOPETZ
Vice President, Production
Blaw-Knox Co., Pittsburgh



P. W. BAKARIAN
President and General Manager
R-N Corp., New York

line. High-volume scrap cutting is at best periodic.

Further flexibility of supply is shown by the Monongahela Valley oxygen plant now being built by Linde. The 1000-ton-a-day plant and its 7½ mile pipeline represent the largest single contract for oxygen supply to the steel industry. The plant will supply the high purity oxygen requirements of U. S. Steel's Duquesne, Edgar Thomson, Homestead, and National Tube Works. Facilities already installed are able to store a liquid equivalent of 10 million cu ft.

This Monongahela Valley system presages tomorrow's methods for oxygen supply: A reliable producing plant, gas storage, and facilities for liquid oxygen storage and conversion. Economy requires large scale production units at or near capacity. Shipped liquid oxygen will continue to be important as a bridge.

Users Start To Increase Size of Sinter Facilities

—PHILIP J. BERG

• In the years ahead, look for further advances in sintering in the U. S. and other parts of the world.

Last year, Dravo figured in sintering facilities which will boost annual output some 11 million tons.

Evidence of the demand: Jones & Laughlin Steel Corp.'s contract with us for a 13 ft 2 in. sinter strand (2410 sq ft) which will turn out 6500 tons per day. To our knowledge, it's the widest and largest equipment of this kind under construction in this country. (Two others the same size are being built in Australia.)

We have plans on the drawing boards for equipment with a hearth area of 3000 sq ft that will produce 9000 tons a day.

The trend to wider strands has been prompted by the results of present equipment (8 or 12 ft widths): Increased tonnage, reduced coke consumption, and the ability to add limestone (flux) to a charge before it reaches the furnace and hearth area.

Other advantages include: Lower initial investment per ton of output, less auxiliary equipment, and cheaper operating and maintenance costs.

Electric Furnaces Can Cut Cost of Adding Capacity

—F. B. O'MARA

• With the nation's industrial economy shifting rapidly back into high gear, steelmen are taking another look at anticipated capacities needed during the "soaring sixties."

Financing the expansion looms as the major problem, and once again the electric furnace is looking better and better to those concerned with the production of molten pig iron or steel from directly reduced iron.

Electric furnace pig as a hot charge and a variety of direct reduction methods for charging electrics will be integrated in steel operations.

Better Steels Are Needed By Processing Industries

—GEORGE E. KOPETZ

• The chemical, petroleum, and petrochemical industries urgently need better metals for pressurized processes in difficult temperature and corrosive situations. High pressures demand strength at temperatures and at corrosive conditions that make carbon steel entirely unsuitable. There is great need for better creep and rupture-strength properties of the 300 series stainless steels, or for the development of a new series of alloys of superior properties with excellent corrosion resistance at 1400 to 1800° F, and good resistance to the corrosive effects of sulfides and sulfur compounds generally at those temperatures. (The reaction is analogous to oxidation.)

Nonmetallic coatings will become important throughout the process industries. Those which protect against elevated temperature and corrosives will stretch applications of high strength metals to new levels.

Says Direct Reduction Is at Commercial Stage

—P. W. BAKARIAN

• The direct reduction method of converting high and low grade ores to metallic iron is ready for full scale commercial production.

Direct reduction should become a significant factor for new world iron capacity which will be programmed during the next ten years.

Such processes are being closely watched. They bridge the gap from ore to the electric or open hearth furnace in one step and produce iron of controlled quality. Iron can be produced from low grade ores which are widely available but presently not usable—containing up to 50 per cent silica and as little as 25 per cent iron. Low cost bituminous coals are used in the place of metallurgical coking coals.

More emphasis is being placed on circumventing blast furnace and coke oven costs. Management is pressing for more

output from present combinations.

Three alternate cost approaches are being surveyed: New facilities plus the upgrading of low grade ores and agglomerating them for the blast furnace; the use of higher grade and more expensive foreign ores, which in many cases must be sintered for blast furnaces; and direct reduction.

Large scale plant tests indicate that improved ore yield, controlled composition of the iron briquets, and lower original plant investment are possible through direct reduction. Each geographic location is getting economic evaluation to compare direct reduction and a new blast furnace.

These factors are considered:

Location of low cost, noncoking coals.

Location of proper iron ores.

The need for ore upgrading and agglomeration.

Channeling high grade, coarse ore to present blast furnaces and using lesser grade ores in direct reduction processes.

Basic Oxygen Will Produce 15 Million Tons by 1961

—H. B. EMERICK

• Basic oxygen steelmaking is rapidly becoming a process of major importance. It combines advantages of the basic open hearth and bessemer converter, while eliminating many deficiencies.

Finished oxygen steel is quite low in phosphorus, sulfur, and nitrogen. It has excellent welding and cold forming properties.

Our new basic oxygen steel plant at Aliquippa, Pa., has two furnaces with a charge capacity of 65 tons. That has been increased routinely to 90 tons and experimentally to 120 tons, including 25 to 30 per cent scrap. Plant capacity is 750,000 ingot tons a year. (A production cycle gives 88 tons of finished steel per hour.)

Five plants using basic oxygen processes are now operating in Canada and the U. S., and others are under construction. World capacity will grow to nearly 15 million tons within the next two years. Continued development and improved design will make the process a strong competitor of the open hearth.

Oxygen Ups Output, Cuts Need for New Equipment

—N. P. GOSS

• Look for more oxygen this year in refining, especially in open hearths and electrics. That will increase the ton per hour output without new equipment.

Blast furnace output will be increased through more sinter and increased driving rate. Reducing lime and coke will also increase output, but will require external desiliconization and desulfurization. Several processes are under development.

The Perrin and Diamond rotary reactors are examples. Both quickly reduce silicon and sulfur from metal in one operation. Desiliconized iron from the blast furnace would be an ideal charge for electrics, and would reduce dependence on scrap. The ideal charge for electrics would be molten iron reduced with carbon in the Diamond rotary reactor. It would make the operation independent of the blast furnace (it can be a bottleneck).

Vacuum degassing will continue to grow. That's not the only profitable means for gas removal. Some new ones are under consideration.

As long as steel is poured into an ingot mold, piping, segregation, surface defects, nonuniformity of physicals, and excessive cropping will be problems. Surface conditioning alone costs in excess of $100 million each year.

The way out of that dilemma is to produce an ingot with a suitable surface. One way is continuous casting. Nearly perfect surfaces can be expected.

Exacting control of friction in continuous casting is still a problem. Several methods are under test to control it. Once that is conquered, surface defects, internal cracking, breakouts, and hangups will no longer be problems. Then you can expect greater use of continuous casting. Most logical fields for immediate application: Stainless and tool steels.

Hot extrusion could be greatly enhanced by continuous casting billets with excellent surfaces, cut to length at 2000° F, and glass coated in a furnace.

Here Are 18 Ways Progress Will Come to Steelmaking

—F. M. RICH

• Steel in the years to come will continue to replace traditional arts with precise science.

Probably the greatest attention will be paid to the automatic control of steel production and rolling.

Here is a priority list of improvements in iron, steel, and flat products production:

Improvement of raw materials and inclusion of fluxing agents.

Oxygen blast enrichment.

Humidified blast and higher blast temperatures.

More furnaces operating at high top pressure with increased top pressure levels.

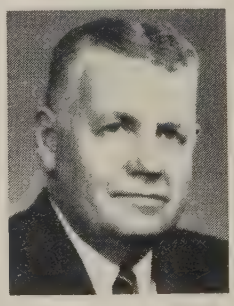
Automation of blast furnace charging sequences and stove changing.

Better tapping hole refractories to permit a fluidized stock column through the casting period.

Steelmaking

H. B. EMERICK
Technical Services Director
Jones & Laughlin Steel Corp.
Pittsburgh

N. P. GOSS
Consultant
Cleveland



F. M. RICH
General Manager, Indiana Harbor Works, Inland Steel Co.
East Chicago, Ind.

Possible commercial adoption of new ways to reduce iron ores.

Improvement in open hearth production through oxygen, particularly in roof jets.

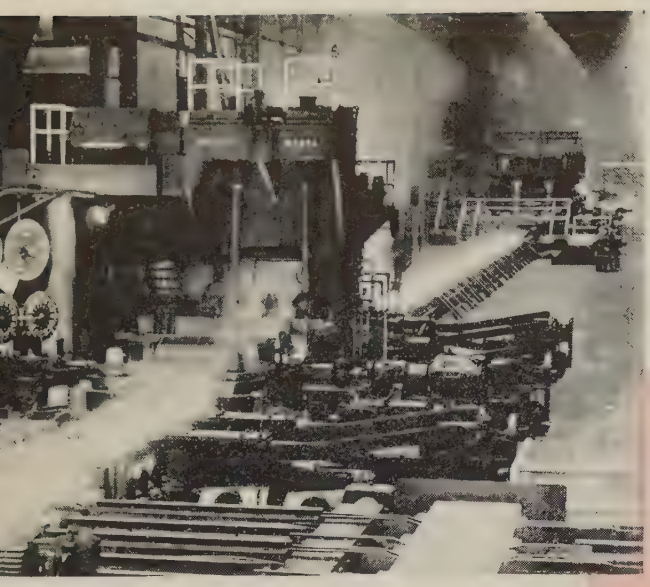
Better open hearth refractories and roofs to improve furnace availability.

More natural gas in some areas which will bring changes in furnace and burner design.

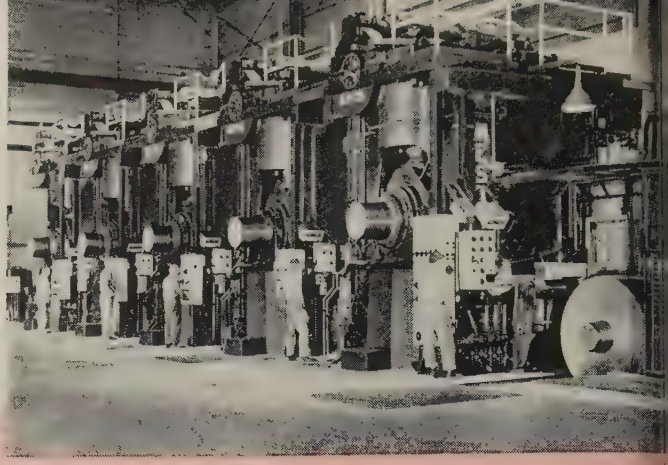
Oxygen steelmaking growth to at least 4.4 million tons by the end of 1959.

Completely automated slabbing mills.

(*Please turn to Page* 202)



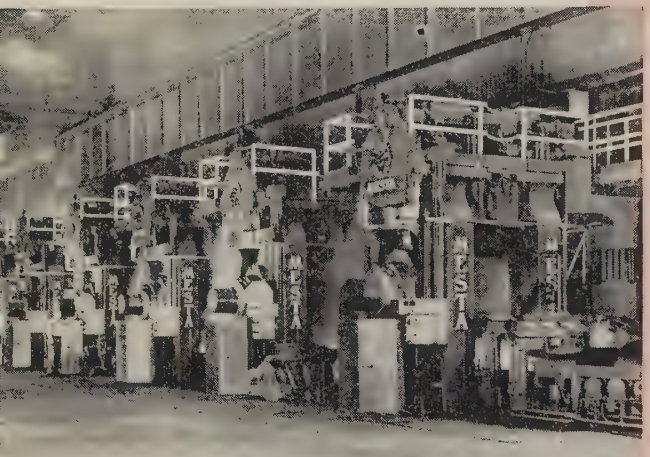
Universal Reversing Roughing Mill and Vertical Edging Mill — Automatically Controlled — on a MESTA 44″ Hot Strip Mill



MESTA 48″ Four-High Five-Stand Tandem Cold Mill Rolling Strip Steel for Tin Plate in Coils

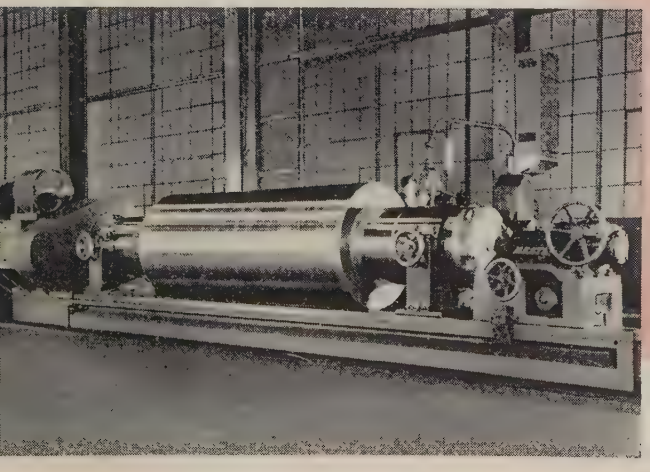
MESTA

DESIGNERS AND BUILDERS OF COMPLETE STEEL PLANTS



Six Finishing Stands with Three Vertical Edgers on a MESTA 44″ Four-High Hot Strip Mill

In this, the 200th Anniversary of Pittsburgh, Mesta Machine Company is proud of its more than 60 years a a leader in the development, design, and manufacture o rolling mills and auxiliary processing equipment forging presses, and heavy duty machinery for complet steel and aluminum plants. The name MESTA is a symbo of quality to these progressive industries here, and i other countries, in their goals to produce more an better products.

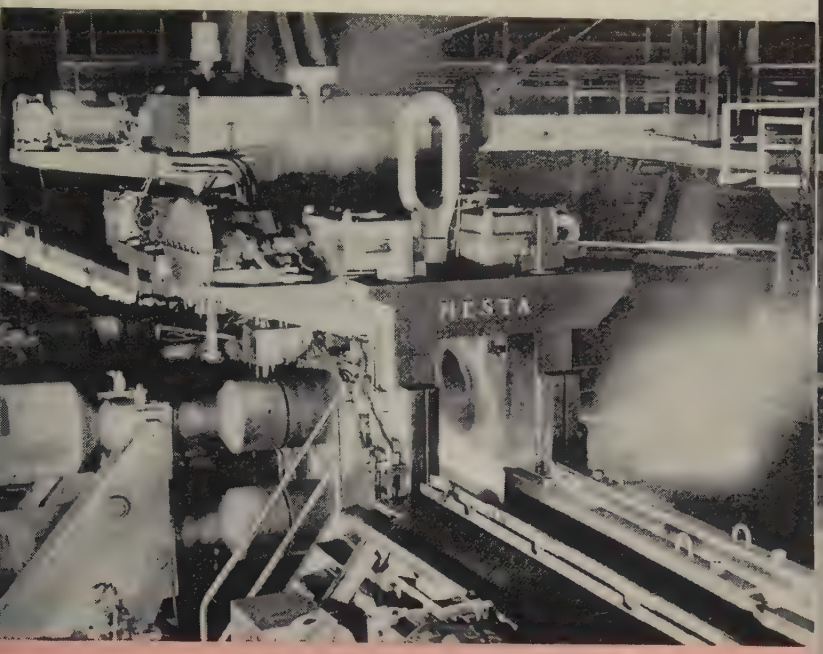


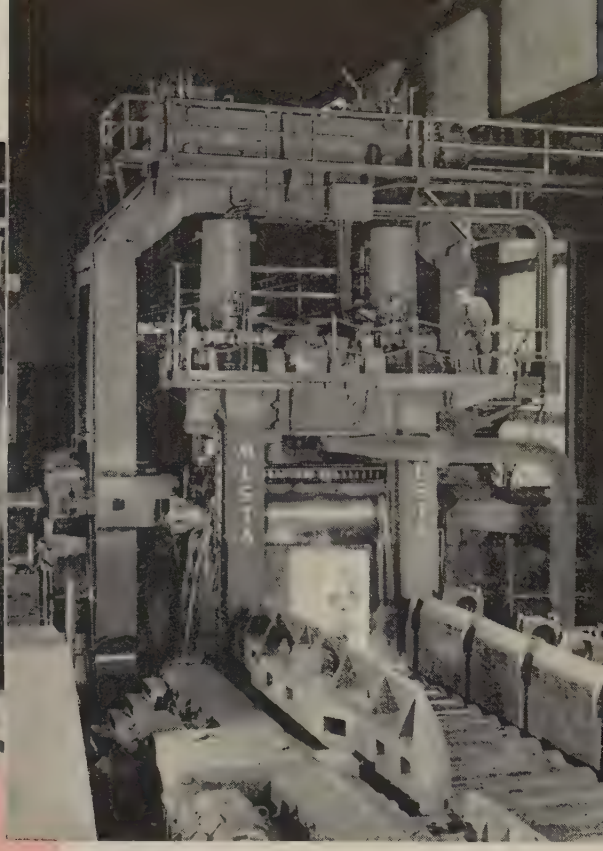
MESTA 60″ Travelling Wheel Type Heavy Duty Roll Grinder Finishing a Backing-Up Roll

MESTA MACHINE COMPANY

PITTSBURGH, PENNSYLVANIA

MESTA Universal Structural Mill Rolling Wide Flange Beams on the 44″ Universal Stand and the 34″ Edging Stand

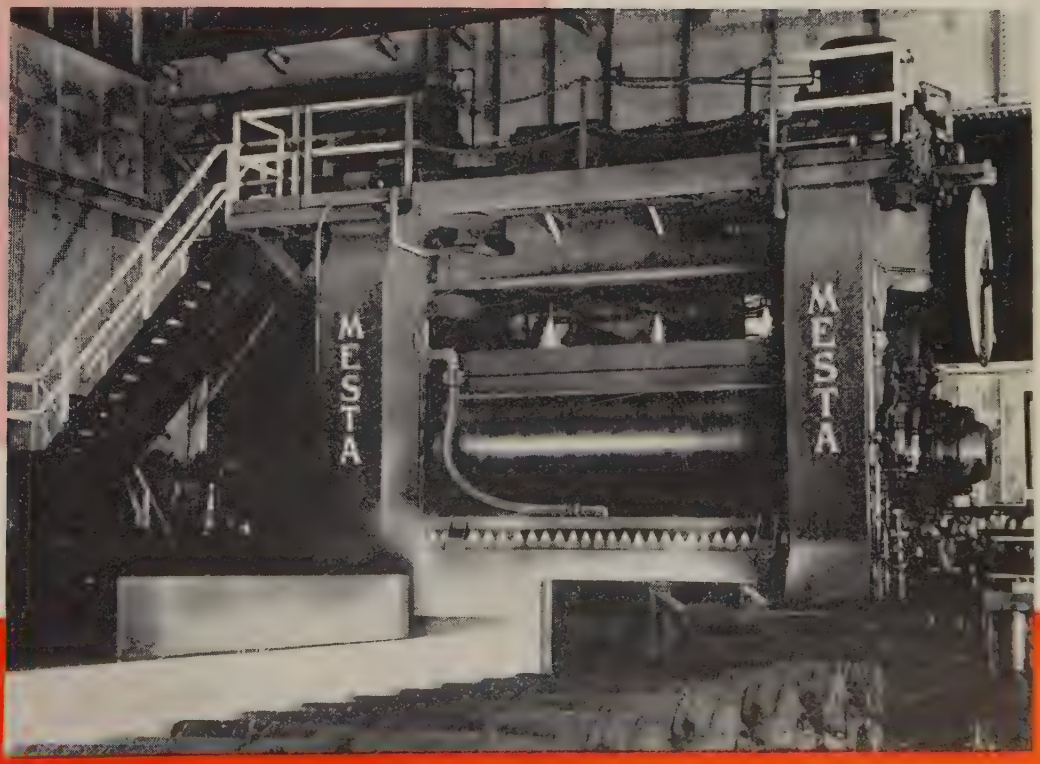




Rolling 20 Ton Ingots into Slabs on a MESTA 45″ x 90″ Universal Reversing Slabbing Mill

ITTSBURGH BICENTENNIAL
1758 — 1958

GATEWAY TO THE FUTURE



MESTA 160″ Four-High Reversing Plate Mill

Steelmaking

LEO F. REINARTZ
Consultant, Armco Steel Corp.
Middletown, Ohio

HAROLD ROWEN
General Manager, Dwight-Lloyd Div.
McDowell Co. Inc., Cleveland

G. G. BEARD
President, United Engineering &
Foundry Co., Pittsburgh

(We are attempting to do this at Inland and feel that we'll be successful.)

Complete automation on hot strip mills through the rough and finishing stands.

Improvement of gage run-down on hot mill coils.

New controls on hot mill coilers (2200 and 2300 fpm) to eliminate telescoping.

More high speed tandem cold strip mills making coils of 1000 lb per inch of width.

Coils heat treated for vitreous enameling.

High speed electrolytic tinning lines becoming faster with automatic determination and recording of coating weight.

Electrolytic tin plate made in coils.

Steelmaking Modifications Up Unit Output Efficiency

—LEO F. REINARTZ

• High grade foreign iron ores will be imported in increasingly large tonnages. Taconite pellet production will increase.

More companies will install ore sizing and blending facilities. Limestone will also be crushed to uniform size.

Sintering of iron ore fines and flue dust will continue to grow. Quality will improve by controlled addition of ground limestone.

New sintering machines will be wider (up to 12 ft) and deeper beds will be used (up to 15 in.). Large, circular dry coolers will become popular.

Sometime in the future, blast furnace and coke oven gas may replace some of the coke now used.

New blast furnaces will have 28 to 31 ft hearths. Heating capacities will be higher. Blast temperatures approaching 1800° F will be used, with moisture running from 8 to 24 grains.

Tops will be reinforced for 18 to 20 lb pressures. Such furnaces should produce 3000 tons a day.

Some people may try an auxiliary set of small tuyeres above the regular ones near the top of the bosh to inject reformed natural gas, fuel oil, or coke oven gas with oxygen.

Several direct reduction processes are nearing the end of the pilot stage. The problem is now one of economics. Capital costs will be lower than those of the conventional coke oven-blast furnace design. Operating costs should equal those of the open hearth.

Through structural modifications, practically every open hearth furnace in the U. S. ten years old can produce 10 to 30 per cent more per year.

New furnaces will have capacities of 300 to 400 tons. To increase ingot tonnage, many old furnaces will be changed to an all-basic design. I predict that new ones will be all-basic.

More attention will be given to automatic combustion control and high velocity short flames.

The International Flame Research Committee has been doing good work with the open hearth. Its success will encourage American engineers to build models for improving fuel combustion.

I predict that new on-site oxygen production plants will increase. Oxygen consumption (now at 200 cu ft per ingot ton) will expand to 1000 cu ft in the next five years.

To obtain optimum results from oxygen methods, baths should be deepened, roofs raised, hearth areas increased, and all-basic furnace designs adopted.

Predicts Complete Burdens Of Self-Fluxing Sinter

—HAROLD ROWEN

• Complete burdens of self-fluxing sinter are definitely in the cards for ferrous industries, both here and abroad. The Swedes have proved its practicality; the Russians apparently are following suit.

Determined efforts to increase blast furnace production, to cut coke needs, to reduce flue dust losses, and to lower production costs have proved that presmelting beneficiation relieves the blast furnace workload. Results will be lower requirements for high grade coke.

The sinter machine will continue to play a major role, and a new science of sintering will evolve. The familiar burnerman will be replaced by a technician. He will preset mixes (moisture, fuel, and ignition) automatically. Oxidation or reduction of the sinter and burnthrough will be precisely controlled.

Such material mixes of uniform porosity and strength will lead to 75 per cent (or higher) furnace charges. More studies of movement in the blast furnace stack will eliminate the old fears of excessive hanging and scaffold formation.

Steelmen will consider crushing refractory lump ore and sintering it, to raise the smelting area and produce more iron.

Sintering people will play a bigger role in controlling the blast furnace charge. Fluxes will be added to the sintering machine burden in fine, more efficient grain sizes. Proper mixing will enable the use of fines without fear of increased flue dust since they will be "sintered in."

Sintering people can expect lubricated tight seals, maintenance of exhaust gas temperatures which will prevent duct and collector corrosion, control of process dusts, more and better instrumentation.

Sintering is being accepted as an integral, indispensable part of steelmaking.

Continuous Casting Slated For Intensive Study

—G. G. BEARD

• The steel industry will make strides in the mine-to-pig operations, involving ore beneficiation and sintering, coal cleaning and preparation, oxygen blow converters, and direct reduction of iron ore.

Continuous casting of ingots will justify concentrated study. Ten in. square alloy and silicon steel ingots and 6 in. by 25 in. stainless and carbon steel ingots are

Steelmaking

M. W. LIGHTNER
Vice President, Applied Research
U. S. Steel Corp., Pittsburgh

being made semicommercially.

We look for continued effort to produce more accurate strip with fewer edge-to-center and end-to-end variations.

Automation will continue. Card programming of reversing roughers in semicontinuous hot strip, slabbing, and structural mills, has shown improvements. You can expect computer techniques to modify rolling schedules automatically.

Aircraft and military people are exerting pressure for new, rare metals in strip form. Titanium, molybdenum, beryllium, and superalloys involve new and special problems of manufacture. Problems of dimension (wider, thinner, flatter, and more accurate strip down to one-fourth of the standard AISI tolerances) and the small tonnages involved will lead to special rolling techniques: Sandwich rolling and special rolling mills for both hot and cold rolling.

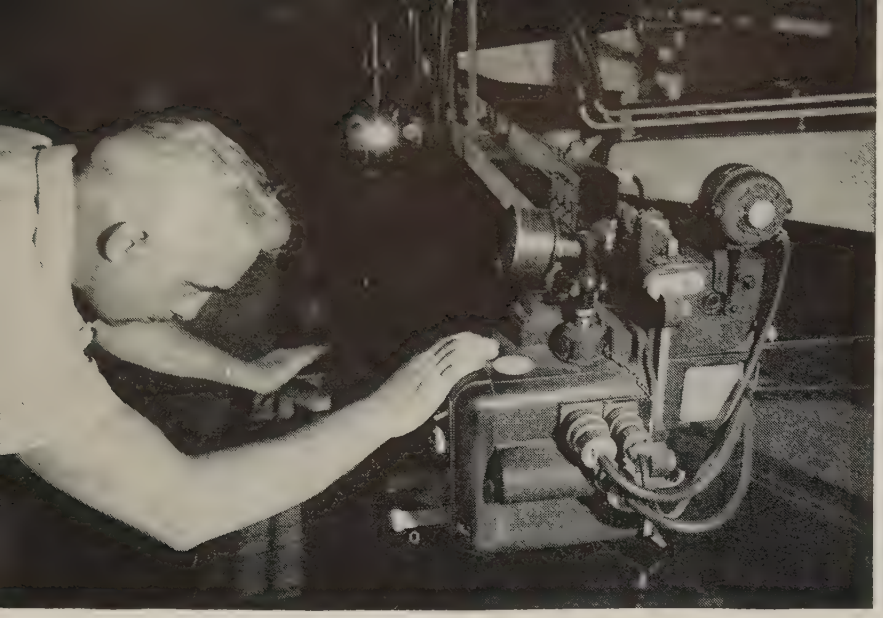
In the general commercial strip rolling field, there will be expansion and development in the finishing end. Strip pickling, including mechanical descaling, will exceed 600 fpm; continuous electrolytic cleaning and annealing of tin plate will approach 2000 fpm; high speed electrolytic tinning in coil form will also be up around 2000 fpm.

Oxygen, Basic Roofs, Vacuum Will Bring Major Benefits

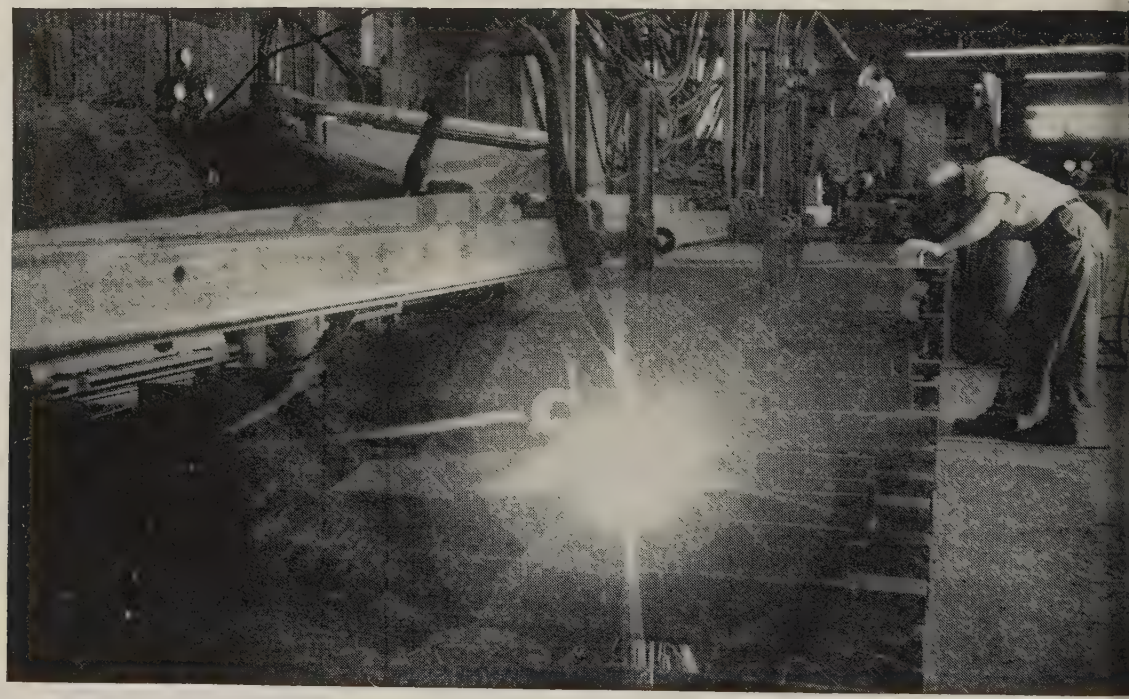
—M. W. LIGHTNER

• The most far reaching development is low cost, high purity oxygen. Oxygen plants will soon be a necessary part of all steel mills.

(*Please turn to Page* 208)



NOW IT'S TO CUT



EASIER THAN EVER
HEAVY STAINLESS PLATES

New technique cuts irregular shapes from 2″ Stainless Steel plates without post-machining or annealing

TODAY, when a designer knows that a particular part should be made from Stainless Steel, he doesn't have to settle for a substitute material because of fabrication difficulties. Fabricators aren't stymied by Stainless Steel. They've learned that this miracle metal isn't difficult to fabricate—it's just different—and they've developed new equipment and methods to fabricate it.

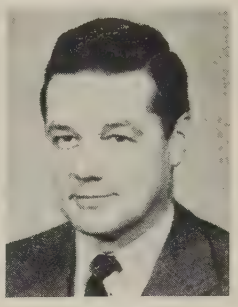
A good example is the gas-shielded arc cutter used by **Morrison Steel Company,** New Brunswick, New Jersey, a leading Steel Service Center selling USS Stainless Steels. The gas mixture shields the Stainless and protects the kerf wall from oxidation. The combined heat of the arc and force of the gas stream make a smooth cut that seldom needs post-machining or annealing to attain a smooth edge and good microstructure.

By assuring close tolerances and eliminating contamination, this type of cutting opens new avenues to design engineers and cost-conscious production men. And most remarkable of all—virtually any irregular shape can be cut from Stainless Steel plates *up to 2″ thick.*

Developments such as this prove the adage that "service sells steel," a philosophy firmly held by Steel Service Centers selling USS Stainless Steel. To be assured of service-tested quality when you order Stainless from a Steel Service Center, specify USS Stainless Steel.

USS is a registered trademark

Steelmaking



JOHN P. HOLT
Executive Assistant to Vice President, Basic Inc., Cleveland

Much work remains to be done before we will know whether any direct reduction method will compete with the blast furnace. We must not overlook the increased productive potential of blast furnaces, with fully beneficiated burdens, self-fluxing sinter, high top pressure, and oxygen enrichment of the blast.

A practical and economical open hearth roof using basic brick stimulated construction.

About 75 basic roofs will soon be in use. They will permit higher firing rates and with oxygen roof lances will increase open hearth productivity.

Vacuum casting of steel, which originated among producers of heavy forgings, is finding favor among the specialty steel producers. Much experimentation and evaluation of vacuum process quality remains to be done.

Oxygen Trend Will Require Improved Basic Refractories

—JOHN P. HOLT

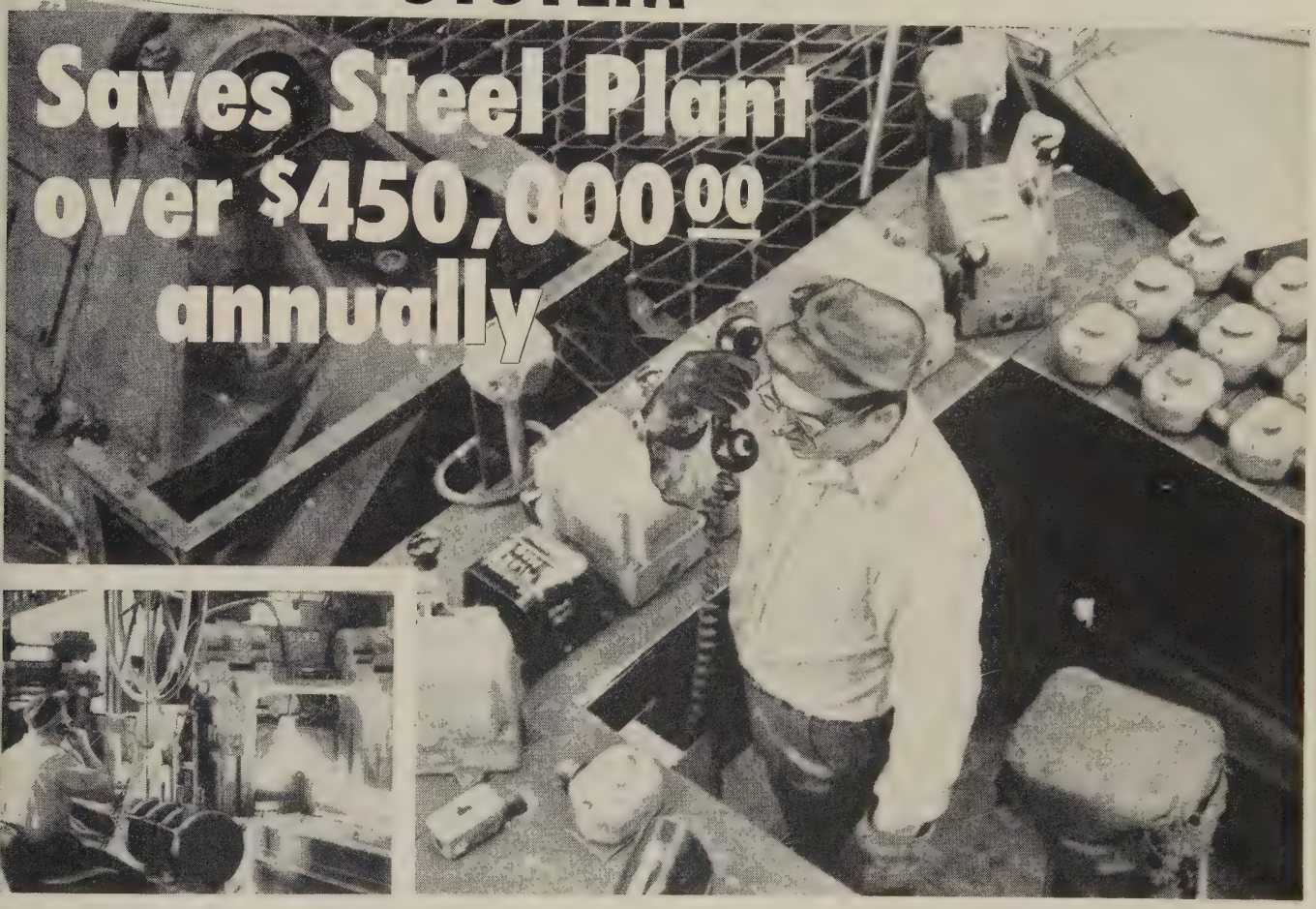
• By the end of 1959, oxygen converters may produce 5 million tons. By 1965, that could be tripled.

Open hearth shops won't be scrapped. They will be around for many years to come, but will face competitive pressure from oxygen steelmakers. He has already accepted that challenge: Witness the production of 40 tons of steel per hour. Some even turn out 65 tons per hour.

Oxygen has been a principal factor in those records. It plus increased firing rates and more automatic control will lead to productivity undreamed of ten years ago.

Greater open hearth production rates

NEILL *Engineered* COMMUNICATING SYSTEM*



NORTHWESTERN STEEL & WIRE CO. STERLING, ILLINOIS

ENGINEERED NEILL LOUD SPEAKER COMMUNICATING SYSTEMS are proving in installation after installation to be cost-cutting, efficiency-raising production tools. They pay for themselves in weeks in man hour reductions, elimination of mill returns and in accident prevention.

- The figure shown above is a conservative estimate. Actually, these savings will prove much greater over a period of time.
- It may pay you to talk with one of our engineers—without obligation of course.
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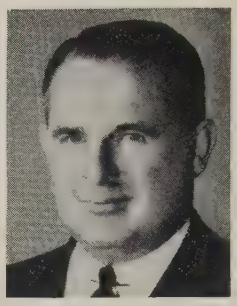
Steelmaking



G. E. DRAKE
Vice President, Electro Metallurgical Co.
A division of Union Carbide Corp.
New York

and increased oxygen input means a sharp stepup in the deterioration of refractories. Many operators are building all-basic furnaces, a trend that is likely to gain momentum.

Despite the superior resistance of basic refractories, certain areas such as skewbacks, front walls, and front piers will give out more rapidly than other parts. A promising repair method: Gunning granular basic refractories onto eroded spots.

At present, gun maintenance is practical under certain conditions. Improvements will come in the near future. Development of the technique is a must if we are to realize full measure of the potentials in the open hearth.

Two New Ferroalloys Will Aid Steelmakers

—G. E. DRAKE

• Rising steel production during the second half of 1958 could not do much to lift ferroalloy sales. Total alloy sales estimates for 1958 were about 80 per cent of 1957 sales. They should increase by about 25 per cent next year.

The 1958 price picture was relatively stable. The year ahead holds no promise for firm prices.

A bright spot in ferroalloys is stainless steel production, which recovered more rapidly than steel as a whole. We expect 1959 will top 1 million ingot tons.

A highlight of that picture is the record being set by 200 series stainless steels. That was partially responsible for providing a better position for chromium and manganese.

Two new ferroalloys were introduced

(*Please turn to Page* 212)

Steelmaking

R. P. HEUER
Vice President, General Refractories Co., Philadelphia

which will aid economical steelmaking: Ferromanganese-silicon and refined charge chrome. This year, special alloy compositions, such as a new vacuum-processed, low carbon ferrochrome, will be introduced for more economical furnace or ladle additions.

The ferroalloy industry will introduce and market high purity, vacuum grade compositions for the growing vacuum melting industry.

The years ahead will see an expanding market for heat resistant alloys. One area of heavy research is the study of effect of rare metal additions to base metals. An example is columbium in low alloys steels to improve the grain and increase toughness. Such work will do much to increase the effectiveness of metals and alloys in severe environments. The ferroalloy industry will contribute much in that area.

All-Basic Open Hearths To Sweep Steelmaking

—R. P. HEUER

• Last year marked the final acceptance of the all-basic open hearth. All-basic open hearth roof construction in the U. S. increased from less than 2 per cent to almost 10 per cent this year.

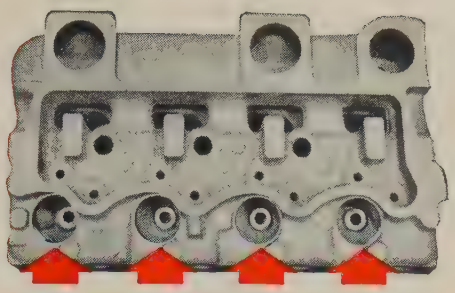
All signs point to accelerated growth during 1959.

Such speed in adopting a new refractory practice is unprecedented.

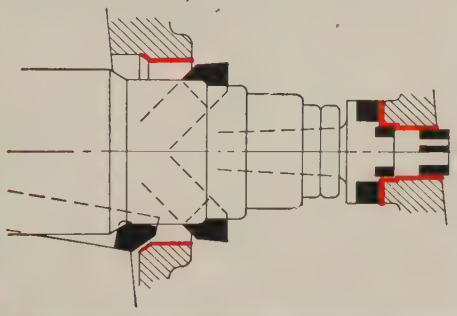
Reasons include increased firing rates and more oxygen for combustion and decarburization.

Wide use of such roofs presage other changes.

Completely basic ends now serve about



MACHINES 21 CYLINDER HEAD SURFACES IN ONE PASS WITH DEPTH OF CUT BETWEEN 1/8" AND 3/16"
Rough castings are bored, plunge-faced and chamfered at a rate of 18 parts per hour. Tooling is shown below.



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A specialist in fast, heavy-duty work such as the multiple machining operations detailed at left, the Style 771 (and the companion double-end Style 772) provides ample work space for complex tooling setups and bulky fixtures.

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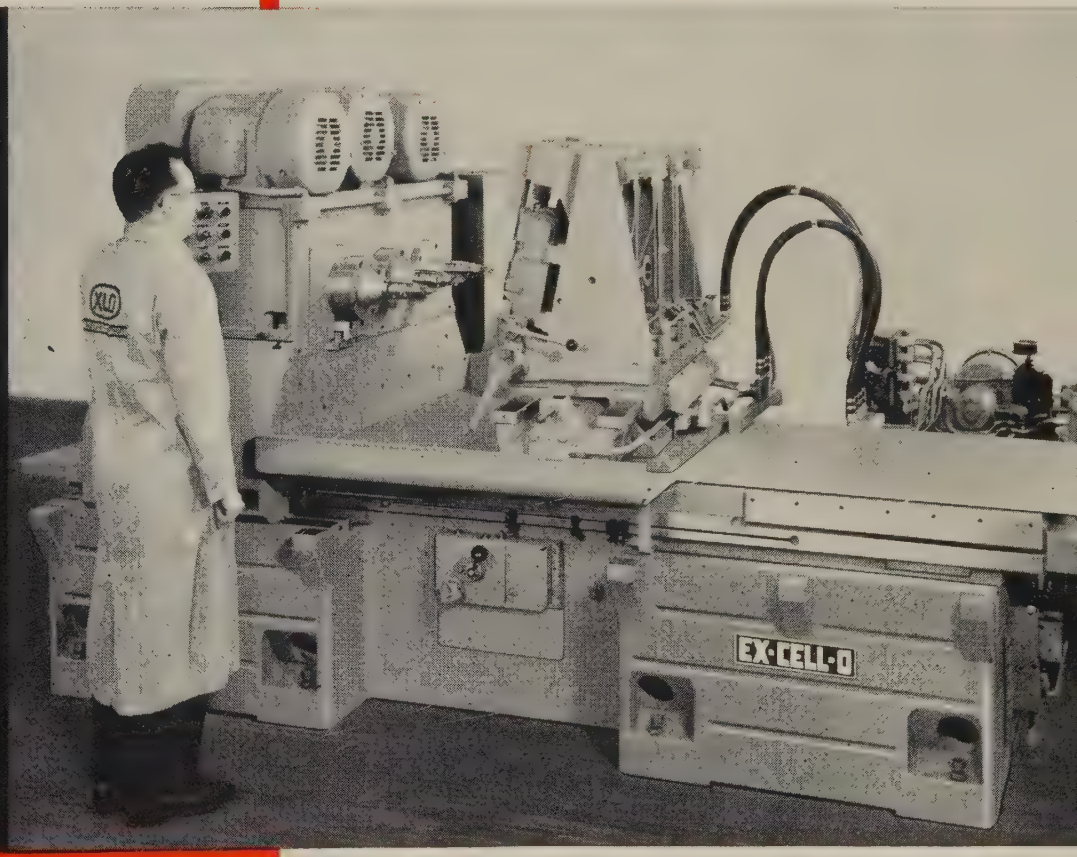
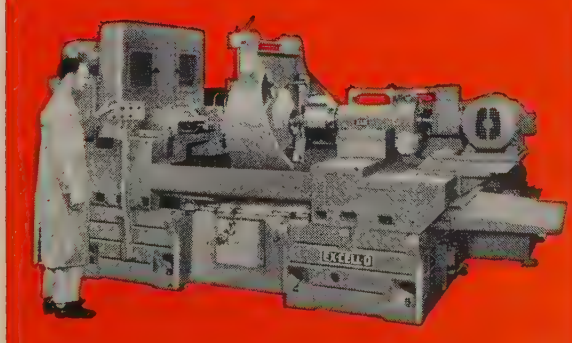
RIGHT: Style 771 machines both 4-and-6-cylinder tractor components. As cycle starts, table rapids to left, spindles rotate and feed traverse begins. At end of stroke, table rapids out to clear tooling; fixture indexes, cycle repeats for second set of holes.

BELOW: Double-end Style 772 performs multiple machining operations on tractor gear case cover.





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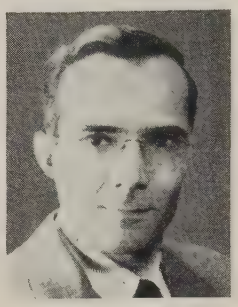
58-49

Steelmaking



H. R. BOATMAN
Asst. Superintendent, Service Dept.
Quality Control, Inland Steel Co.
Chicago

40 per cent of all our open hearths. Increasing conversion of furnace ends to all-basic is certain.

Furnace designs will be modified to take advantage of basic refractories. End structures will be changed to displace the massive venturi port construction. Driven fuel makes smaller ends possible. They can be built to withstand more severe operating conditions.

Smaller ends can increase present furnace capacity without a major capital investment. They require less refractory and improve combustion.

The conversion to all-basic calls for some changes in refractories production. Fortunately, manufacturers have foreseen such needs and have prepared themselves with new facilities and better sources of basic raw materials.

Predicts Wider Use, More Variety for Leaded Steels

—H. R. BOATMAN

• Leaded steels that reduce costs without loss of quality continue to gain popularity.

Only bar size products were made available, raising the question: Can we extend acceptance to such products as thin sheets, plates, forgings, and tubing?

The American Society of Mechanical Engineers (Case 1253) approved the use of leaded steel plates (flame and firebox quality) and forged fittings for application on boilers and unfired pressure vessels. The action should help fabricators reduce costs.

Sprocket makers already are saving with leaded steel plates.

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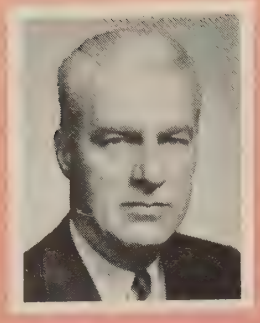
JERRY SINGLETON
Executive Secretary
Magnesium Assn., New York



PIERCE M. WELPTON
President, Bridgeport Rolling Mills Co., Bridgeport, Conn.

F. A. McGONIGLE
Vice President, Howe Sound Co. New York

FORREST M. PALMER
Technical Director, Aluminium Limited Sales Inc., New York

1959 FORUM ON TECHNICAL PROGRESS

Nonferrous Metal Production

Magnesium Sales To Edge Up As New Uses Are Pioneered

—JERRY SINGLETON

• Leading magnesium fabricators are optimistic.

As has been the case since defense requirements became uncertain two years ago, magnesium applications continue to reflect the search and research necessary for improvement of alloys and advancement in processing techniques.

The introduction of new alloys has opened wider the stairway to high temperature uses, to applications where high damping capacity is essential, and to possible cold forming techniques.

Chemical milling has been developed into a useful, practical technique, and new dip brazing methods have proved successful. Advances in mechanical fastening techniques have been announced and are undergoing service testing. A new colorless anodize finish for magnesium could be the critical factor in opening unlimited new areas of application, particularly in consumer goods.

As weight continues to be a critical factor on the road as well as in the air, the willingness to try magnesium despite an inherent reluctance to change becomes more and more apparent. Tooling plate applications continue to grow. Over-the-road equipment gives evidence that it will be an important market—increased fees based upon vehicle weight make greater payloads essential to profitable operation.

The automotive industry has shown extensive interest in magnesium. Its long and successful use by Volkswagen opens the possibility that the upcoming "small" American cars may utilize this light, strong, versatile, easily worked metal.

Continuous Casting To Bring Early Benefits to Brass Mills

—PIERCE M. WELPTON

• The major technical question facing the brass mill industry this year is whether it will be able to make progress fast enough to meet the demands of our country, the customer, and the consumer. I believe the answer lies in the continued awakening of all in the industry to the bold new ideas being offered by forward thinking technical people.

Foremost of the technical ideas available are those on continuous or automated production methods. The brass mill industry has become aware of the need for faster, more versatile, and more accurate equipment that will produce higher quality metals. We recognized this need in 1956 when we arranged to purchase the latest type of Hazelett continuous casting machine. We believe it will have a tremendous impact on the industry in the near future.

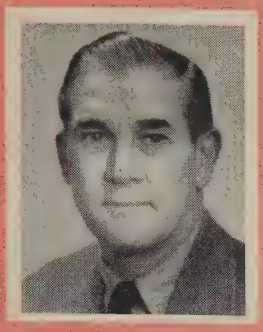
The industry is also beginning to expand the uses of brass and bronze and to develop new alloys to meet the demands of atomic and missile high temperature applications. In the next few years many new alloys will be developed to meet those needs. They will have a major impact on our industry because they will tend to fill the gap left when many brass customers turned to substitute materials to avoid the widely fluctuating copper prices.

Tungsten Points Research Guns On Alloys in the 1800° F Range

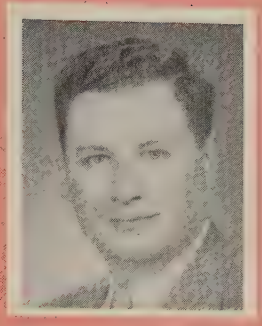
—F. A. McGONIGLE

• The demand for alloys that will operate satisfactorily at 1850° F and higher has accelerated metallurgical research aimed at utilizing the high melting point and recrystallization temperature characteristics of tungsten. Recent reports show promise that increased proportions of tungsten in certain cobalt base alloys demonstrate encouraging properties at 1800° F. New developments on tungsten base alloys indicate further testing may show them to be usable at 1850° F or more.

Tungsten oxidizes catastrophically above 1700° F, hence much of the research is aimed at overcoming this deficiency. A breakthrough on this one problem would mean a major stride toward keeping our



C. P. GOSS
Vice President, Scovill Mfg. Co., Waterbury, Conn.



FRANK H. VANDENBURGH
President, Mallory-Sharon Metals Corp., Niles, Ohio

J. C. DOUGLAS
Vice President-Technology
Electro Metallurgical Co.
Division of Union Carbide Corp.
New York

ROBERT L. ZIEGFELD
Secretary-Treasurer, Lead Industries Assn., New York

metallurgical knowledge from lagging too far behind nuclear and spacial requirements. Reports indicate progress on a coating system has already been made.

Significant progress in the use of vacuum type melting furnaces to prepare alloys and high purity metals is being made and will continue. That technique is of great significance and should become more important as high temperature alloys are produced.

Alloy Research Leading to More Versatile Aluminum Products

—FORREST M. PALMER

• An accelerating development of the aluminum market in terms of tonnage and products is our expectation for 1959.

Our research and development activities will continue to be concentrated in the field of new alloys, producing techniques, and on new industrial uses of aluminum.

Continued emphasis on improving ingot forms for easier, cleaner, safer handling by customers has led to the development of a new interlocking ingot bundle.

Alloy research is leading to more versatile brightening alloys as well as to exploration of new ranges in the magnesium silicide alloy system and close control of presently available alloy variations for special purposes. The successful introduction of Alcan B51S in 1958 illustrates this activity and usage of this alloy should reach major proportions in new aluminum end products in 1959.

High precision, direct chill, cast ingot should significantly aid customers in cost control of material for cold extrusion by both impact and hydraulic methods.

Advances in Continuous Casting Will Improve Brass Mill Goods

—C. P. GOSS

• The coming year will bring considerable development in the continuous casting of copper and aluminum alloys.

In the copper alloy field, the Junghans-Rossi process, the Eldred process, and the direct chill process are all used commercially to produce a wide range of alloys for subsequent working into sheets, rods, wire, and tubes. The direct chill process of casting has been the standard of the aluminum industry for some years, and accounts for nearly all of the rolling slabs and extrusion billets made in this country. Those processes give the producer better castings and assure the customer of sounder, better quality metal.

In addition to the continuous casting processes now used commercially, there has been quite a bit of development work done on newer experimental processes, among them the Hazelett, Tessmann, Hunter-Douglas, and Goss methods. All of those except the Goss method are horizontal processes and offer obvious advantages to a manufacturer.

The use of continuous casting will continue to grow rapidly and the newer processes, now being developed, will become commercial in the next few years.

New High Temperature Alloys, Lower Prices To Aid Titanium

—FRANK H. VANDENBURGH

• Two recent developments point up the growing position and acceptance of titanium:

1. Substantial reductions in titanium sponge, billet, and bar prices indicate that this young industry is moving its products within reach of its countless potential customers.

2. The industry recently announced a group of new alloys which will greatly expand the metal's usefulness in both the aircraft-missile and commercial fields. Elevated temperature limits have been boosted to 1100-1200° F for long time use and to 1500-1600° F for short periods—all important operating conditions for tomorrow's air vehicles.

Commercial users will also be able to take advantage of those new alloys.

Basic producers in the industry have spent, and will continue to spend, substantial sums to develop and improve products and processes.

Zirconium, another of the newer metals rushed to the forefront in recent years, has properties that make it ideally suited for a cladding and structural material in nuclear powerplants. Recent price reductions make it more attractive to commercial builders of atomic powerplants.

Research Opening New Markets For Columbium, Tantalum

—J. C. DOUGLAS

• Columbium and tantalum procedures face a rising demand.

Tantalum demand is swelling under two pressures: The expanding defense program with its accent on missiles and their complex electronic circuitry; and new production and fabricating techniques which are making tantalum sheets, plates, and bars available for the chemical processing industries.

Columbium will be further tested as the major constituent of new jet engine alloys and perhaps as a structural element in breeder reactors. In the next few years, its electronic capabilities are expected to be clarified.

Tantalum will be more prominent than ever in its electronic area as larger sheets and thinner, purer foil is made available. And tantalum will probably gain a secure footing in the chemical processing equipment field in the next few years.

Products of Modern Technology Open Many New Doors to Lead

—ROBERT L. ZIEGFELD

• Developments of the last few years indicate excellent prospects for the wider use of lead and many new applications in the near future.

With a trend to a nuclear-powered

(*Please turn to Page* 220)

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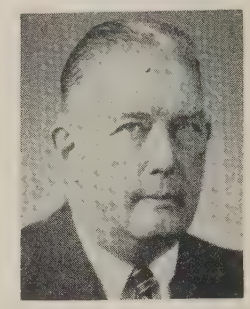
Nonferrous Metal Production

T. E. VELTFORT
Managing Director, Copper & Brass Research Assn.
New York

J. D. HANAWALT
Vice President, Dow Chemical Co.
Midland, Mich.

T. W. LIPPERT
Director of Marketing, Titanium Metals Corp. of America
New York



R. DAVISON
Manager-Market Development
New Jersey Zinc Co., New York

Navy and commercial ships, lead shielding is bound to grow in importance. A single ship may employ upward of 500 tons for shielding.

The many new industrial research laboratories, numbered in the thousands, using radiation sources mean more lead shielding in the laboratory and for shipping radioactive materials. A single cask for shipping spent fuel elements may involve 12 or more tons of lead.

Added to the familiar forms used up to now (such as sheets, castings, shot, bricks, and lead glass) are such newer forms as lead powder in combination with polyethylene and paraffin to provide dual shields and complicated forms.

In the field of electronics, all signs point to greater use of lead in many forms. Lead zirconate-titanate capsules are at the heart of stereophonic sound pickup elements and they may well be important in supersonic dishwashers, washing machines, and other devices of the future. Lead's properties as a superconductor and semiconductor are beginning to be recognized commercially.

Brass Mill Industry's Goal: Better Products and Services

—T. E. VELTFORT

• The brass mill industry continued to move ahead in 1958 with new facilities, products, and processes that will have a favorable impact on the metal-using industries in the months and years ahead. Whether the end product is for today's automobile or an advanced missile, a plumbing line or a solar heating system, the brass mills continue to seek ways to make it better.

The goal of this expansion and development is better customer service. Noteworthy are the two new brass mills on the West Coast. They will provide faster deliveries to users of wrought copper metal products in the western states.

Now available for heat exchanger tube buyers are longer length hairpin tubes with thickened centers which provide nominal wall thickness in bend areas. For added protection against inlet-end erosion, tubes with heavier gage ends are obtainable. New continuous annealing and cleaning machines—in conjunction with appropriate rolling equipment—produce coils of any length, fully cleaned and pickled, while making uniform temper possible at the same time.

Research is progressing on copper metals that will work more efficiently at high temperatures. On the packaging front, the brass mills have supplemented such innovations as pay-off coils with disposable reels to expedite customer operations. Another improvement is the new forging analysis service offered by a New England mill.

Magnesium Set To Assume Wider Role in Metalworking

—J. D. HANAWALT

• Magnesium's prospects in commercial markets have never been better. Its enhanced competitive position should become apparent in the next two or three years.

One of the chief factors is an improved diecasting technology. It results from the development of a technique for metered automatic feed of molten magnesium into cold-chamber machines. Indications are that the process is sufficiently economical to put magnesium in a position to compete in the automotive market.

Another factor is the availability of lower cost mill products, reflecting the development of new alloys and more efficient production methods. For example, a new sheet alloy used by the nation's largest luggage manufacturer is being evaluated in other commercial fields.

With increased commercial applications, economical finishes for both appearance and serviceability will become more important. The development of a clear anodize using a modification of the Dow 17 process is the first step in this direction.

New Titanium Alloys Ready For Aircraft, Missile Demands

—T. W. LIPPERT

• The titanium picture for 1959 will emerge from an amalgam of trends, hopes, hints, and a half-dozen military development programs now shifting into high gear.

The industry seems to have bottomed out, and although month-by-month shipment figures for 1959 may tend to be erratic, the year should show some over-all improvement over 1958.

Three factors must be remembered:

1. Defense activities will remain titanium's major market. Chemical and electronic applications will continue to improve, but those applications unfold rather than burst forth, and consequently take time.

2. Timing in moving current development projects into production will influence shipment patterns. If projects such as the B-70 and F-108 bog down, titanium production will show it.

3. Quantities of aircraft and missiles produced will exert a major influence on pounds of metal sold.

Zinc Diecasting Sales To Increase Sharply in 1959

—R. DAVISON

• With the increased output of passenger cars, appliances, and miscellaneous goods, 1959 will show a sharp increase in zinc use for diecastings.

During early 1958, an unusual amount of redesign activity was underway in durable goods to attract the consumer

ollar toward automobiles and appliances here existing models were making a isappointing sales record. That zinc die-astings have been used intelligently and n large volume on these 1959 models for eauty, efficiency, and economy is now vident.

Galvanizing was one of the brightest pots during the recession—1958 use was lmost identical with 1957's. Even better onsumption should be recorded in 1959 vith culverts for the highway programs nd air conditioning ducts for new and econditioned buildings providing two of he largest markets for galvanized sheets, he most important segment of galva-izing.

Continuous galvanizing continues to pen new markets: The smooth zinc oating on steel sheets results in su-perior paint surfaces which are much n demand to improve the appearance, nd consequently the saleability, of cab-nets of all types.

There are no new tonnage markets n brass, but this market should be greatly improved in 1959. Battery cans, he largest outlet for rolled zinc, are eing helped by the growing popularity f electrically driven mechanical toys.

Predicts Tin Consumption in 1959 Will Top 55,000 Tons

—R. D. COURSEN

• Major consumers and government officials estimate that the domestic consumption of primary tin in 1959 will exceed 55,000 long tons and may equal the 1956 figure of 60,470 tons.

Significant researchwork is underway on the increased use of alloys in the aircraft, nuclear energy, and automotive fields. The use of tin-titanium-aluminum alloy, containing from 2.5 up to 20 per cent tin for jet planes has increased. Further research is underway to develop more advanced tin alloys which also include aluminum.

Of significance in 1959 may be the extended use of reticular tin-aluminum bearings for automobiles. In 1958, these bearings were used in the Italian Fiat automobile. Adoption in the U. S. automobile industry is now possible, as the result of further large scale tests underway by the large bearing manufacturers. Another automotive application of tin is in piston platings.

The perfection of a process for the electrodeposition of tin in a bright condition has opened up new applications in the electrical and electronics fields. Additional examples can be found in such articles as percolators and food machinery. Some of these tin platings are being utilized to take advantage of special properties, like corrosion resistance as in the manufacturing of surgical instruments.

The Tin Research Institute, supported by the major producers, is continuing to press scientific research to develop new uses; new, improved products; and improved processes.

New Brass Mill Equipment Will Spur Efficiency, Cut Costs

—DAVID T. MARVEL

• Brass mills will benefit from the recent sharp increase in industrial activity and inventory liquidation.

Sales should be boosted by the expected boom in residential construction and industry investment in new plants and equipment during the next few years and the increased use of brass in dwelling units.

Continuing competition from foreign brass mills and other metals makes it essential that the industry increase its operating and marketing efficiency at an unprecedented rate.

In this and succeeding years, research programs should have this as one of their main goals: The development of new production techniques and equipment for increasing efficiency and improving quality.

Versatility of equipment is the key to the resurgence of the brass mill industry because of the large variety of alloys it produces.

A major portion of the research effort should be concentrated on improving methods for the casting of rolling mill slabs to incorporate versatility into continuous and semicontinuous casting methods. Improved continuous and semicontinuous processes would make the production of long coils possible. They, in turn, would permit use of higher speed operating equipment, shrink the number of mill operations, and permit more efficient allocation of manpower.

To take full advantage of such developments, it will be necessary to overcome some of the problems inherent in annealing large coils of copper-base alloys. Equipment and processes for high speed strip annealing should be given a top priority in research programs. So should associated temperature control instruments; feeding, cleaning, and coiling equipment; atmosphere controls; and related equipment.

From the consumer's standpoint, the increased efficiency of the industry should act to bridle inflationary trends. Economies should be effected in fabricating by allowing more automation. Uniformity of brass mill products should result in a general improvement in quality.

Growth in Stainless Steel Uses Will Pace Nickel's Recovery

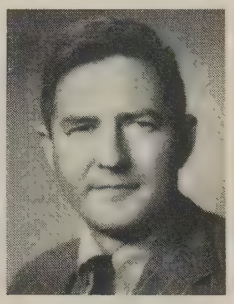
—CHARLES C. RIETH

• This should be a good year for the nickel industry. The brightest spot on the horizon is the future of stainless steel for commercial uses. Now that the stainless steel producers can intensify their sales programs, with the comforting feeling that there will be enough market price nickel available to back up these programs, this industry should certainly forge ahead.

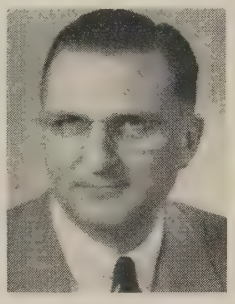
The last year has been a difficult one for the nickel producing and nickel consuming industries, marked by overproduction, heavy inventories, and reduced consumption. It was a far cry from the

(*Please turn to Page 226*)

Nonferrous Metal Production



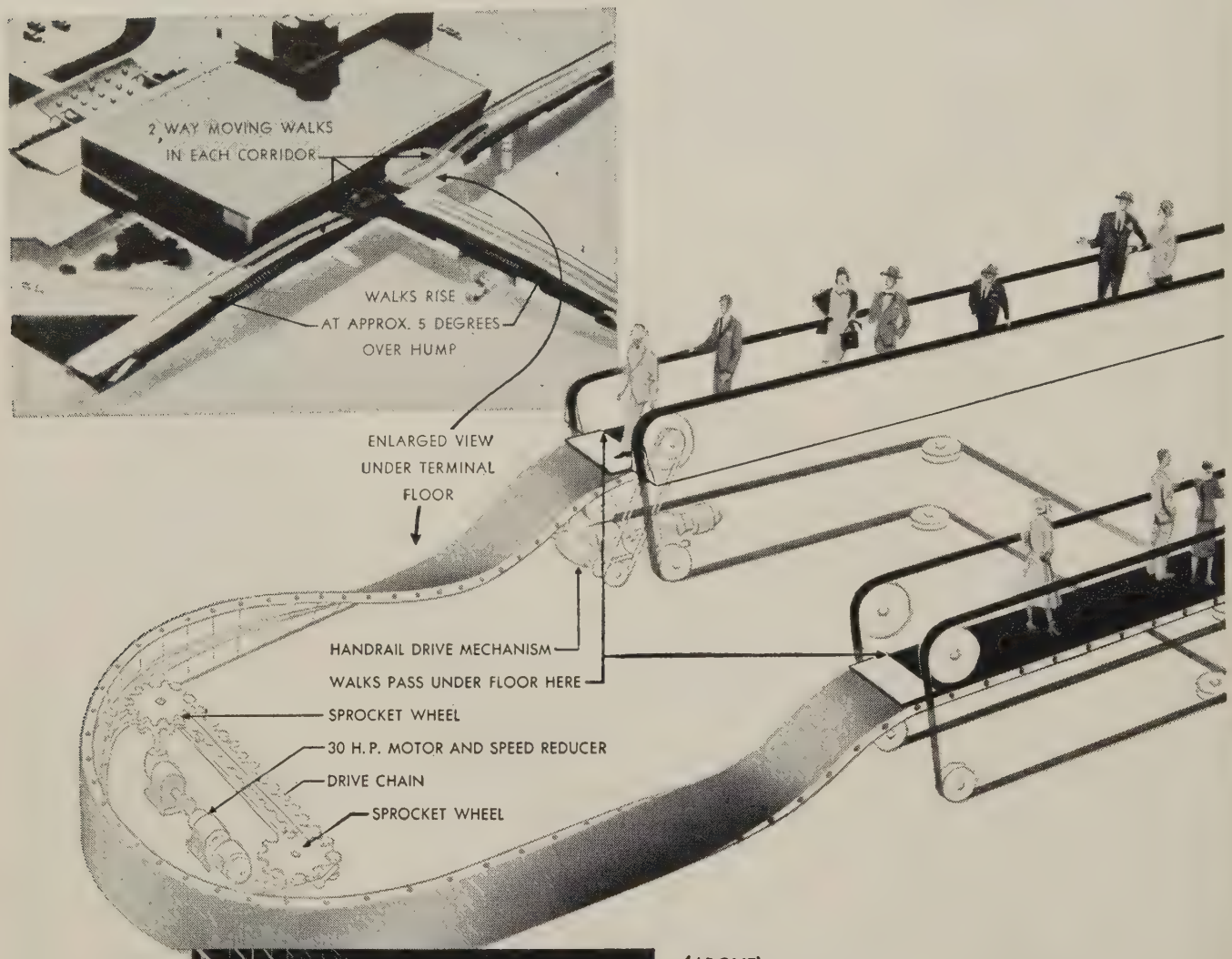
R. D. COURSEN
Director, Malayan Tin Bureau, Washington



DAVID T. MARVEL
Vice President-Brass Sales Metals Div., Olin Mathieson Chemical Corp., New York

CHARLES C. RIETH
Manager-Nickel Sales National Lead Co., New York

REVERE ALUMINUM



(ABOVE)
Schematic drawing showing the "Glide-Ride" moving sidewalk designed, manufactured and installed by HEWITT-ROBINS, INC., at the Love Field Air Terminal, Dallas, Texas.

(Opposite page)
Detail of balustrade with some of the various Revere Aluminum Extrusions used in the conveyors. The unseen track on which the handrail operates is extruded from Revere Bronze shape shown at bottom.

(LEFT)
"Much better than walking," say users of this moving sidewalk that has been a big hit ever since the day it was put into operation.

and BRONZE TEAM UP

to help make the world's longest

"Moving Sidewalk"

an attractive, dependable operation

Placed in operation at the Dallas Love Field Air Terminal, Texas, early in 1958, the world's longest passenger conveyor system has proved the answer to efficient transportation of pedestrians.

The three units which total more than a quarter of a mile in length extend out from the main terminal over three separate bridges to the first loading gate of each finger, carrying passengers in both directions.

These new Glide-Ride conveyors were designed, manufactured and installed by HEWITT-ROBINS, INC. Playing 2 important roles in these conveyors are 22,000 lbs. of Revere Aluminum Extruded Shapes and 22,000 lbs. of Revere Extruded Bronze. The aluminum extrusions were used as floor cove molding, handrail molding, spoon molding between balustrades and rubber carpet, and as a wall cove between handrail and wall. Not only are these Revere Aluminum extrusions attractive and decorative but their satiny finish will remain so for years with an occasional soap and water cleaning the only maintenance required.

Hidden under the moving rail is the track extruded from Revere Bronze, taking constant daily rugged wear in its stride.

The selection of Revere Aluminum and Bronze Extrusions was not a mere matter of specification. It was the result of HEWITT-ROBINS Engineers and Designers consulting with Revere's Technical Advisory Service men in order to determine the alloys and the shapes best suited to do the job required.

And so it is with practically every industry you can name. When you take your supplier into your confidence, discuss your problems with him, you invariably are rewarded with a better product at less cost, because the material finally selected is the *exact* material for the best job.

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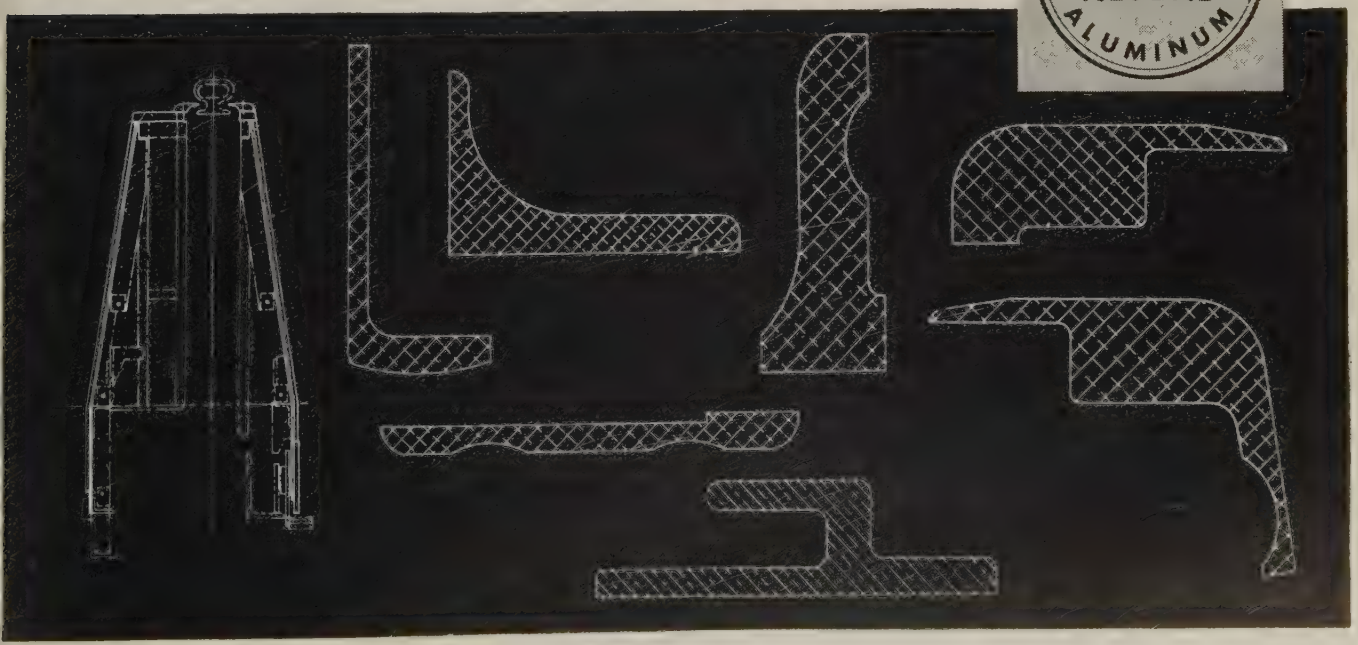
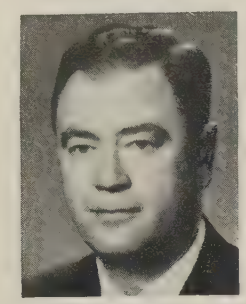


Nonferrous Metal Production



D. A. RHOADES
Vice President & General Manager
Kaiser Aluminum & Chemical Corp.
Oakland, Calif.

SIMON D. STRAUSS
Vice President-Sales
American Smelting & Refining Co.
New York

JOHN D. HARPER
General Manager, Smelting Div.
Aluminum Co. of America
Pittsburgh

prolonged period of shortage that prevailed previously.

During the shortage period, subsitutions were attempted, and in many cases accomplished. It will probably take some time to either regain these markets or develop new outlets.

A disturbing factor during the last year has been the ready availability of low price nickel scrap, and also distress lots of primary materials. However, it is reported that these have just about been dissipated, and scrap prices are now more in line with the cost of primary materials.

It appears that the consumption of nickel for military and defense use will not be as great as it has been.

The difficulties recently encountered in Cuba and Canada have interfered with normal production. If these are of sufficient duration, and business continues to improve, the overhanging inventories can well be materially reduced within a reasonable length of time. Barring international complications, it does not appear that there will be any serious or long-lasting nickel shortage for the foreseeable future.

The new space age will require a wide variety of new alloys. The flexibility and availability of the raw materials for these programs will be of vital importance. I confidently believe that the various nickel producers will meet these challenges, from a technological standpoint, and perpetuate the strategic importance of nickel.

A competitive market is in prospect and a real selling job will have to be done. This will be a healthy situation for all parties concerned.

Aluminum Breakthrough Seen As Major New Uses Open Up

—D. A. RHOADES

• We view 1959 as a year of rapid progress for new aluminum applications in many of the nation's most important industries. Major applications for aluminum which have been in development over long periods of time are now fully engineered, tested, and ready for adoption.

In aluminum, we are due for continuing breakthroughs on many fronts, both in 1959 and the years immediately following. Those breakthroughs will occur in some of our great industries—automotive, residential building, transport, food packaging, and the consumer durable goods industry, to name only a few.

The automotive industry will increase its aluminum usage by nearly 50 per cent in 1959 by conversions to aluminum in many automotive components, both functional and decorative. That estimate does not include several major conversions to aluminum such as engine blocks, integral wheels and brake drums, radiators, and bumpers. All of these, we believe, will be adopted within the next few years.

Developments in food distribution and merchandising, including aluminum cans, semirigid aluminum food containers and aluminum foil packaging, are already consuming many millions of pounds. Electrical conductor applications—transmission and distribution lines, building wire, and many varieties of insulated cable—also offer a rapidly growing market. The electrical industry as a whole is now using nearly 500 million lb of aluminum annually.

Lead and Zinc Production and Sales To Rise, Imports To Fall

—SIMON D. STRAUSS

• Assuming maintenance of at least year-end prices, production of lead at domestic mines during 1959 may average 26,000 tons a month, against 24,000 in 1958 and 28,000 in 1957. Domestic mine production of zinc is likely to be about 38,000 tons a month this year, against 35,000 in 1958 and 43,000 in 1957.

Imports during 1959 will be substantially less than they were in 1958 if the quota system is maintained. However, the limiting effect of quotas may be somewhat offset by U. S. government purchases of imported metal under barter transactions, which are not subject to quota limitations.

Deliveries of lead and zinc to fabricators will doubtless be considerably greater than they were last year. Even though imports are limited by quotas, there will be no difficulty (barring serious labor troubles) in supplying industrial demand because substantial stocks are still held by domestic producers. However, in the event of a prolonged strike the government would probably relax quotas. Most labor contracts in the domestic nonferrous metal industry expire in June, 1959.

Aluminum Supply Is Adequate To Meet Foreseeable Demand

—JOHN D. HARPER

• Today our customers need have no fear that the supply of aluminum will be limited. Basic producers are confident they can provide sufficient metal to meet the demands of all the burgeoning markets.

With the start of operations by two new basic producers, and the completion of new facilities by four others, the domestic primary aluminum capacity figure has increased 15 per cent since 1957.

Despite the decreased demand for aluminum in 1958, plans for the addition of new capacity have suffered no outright cancellations—the construction of such projects has been stretched out where possible. Completion of these projects (some at various stages of construction and some close to completion) will ultimately increase the domestic capacity to 2.6 million tons, up nearly 23 per cent from the current level.

The total U. S. aluminum supply picture includes imported tonnages, principally from Canada. The secondary aluminum suppliers remelt old and new scrap to provide sound metal for many consuming industries. When final figures are in for 1958, total metal supply from all sources is expected to be about 8 or 9 per cent below 1957 levels.

One of Alcoa's recently announced projects is the so-called Brokopondo Development, on the Surinam River in the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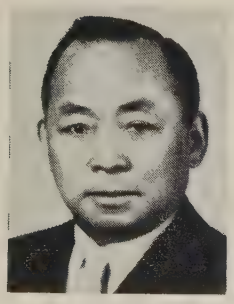
Nonferrous Metal Production

J. L. KIMBERLEY
Executive Vice President
American Zinc Institute
New York

CHARLES H. WINSHIP JR.
Vice President, Phelps Dodge
Corp., New York



K. C. LI
Chief Engineer, Wah Chang Corp.
New York

interior of Surinam (formerly Dutch Guiana) and the site of Alcoa's principal source of bauxite. It provides for the start of construction by 1960 of a dam, powerhouse, and transmission line to supply 150,000 kw.

In addition, Alcoa will build a 60,000 ton aluminum smelter near the bauxite mining center of Paranam. The over-all project, which includes the eventual construction of a bauxite refining plant utilizing local ore deposits, will involve total expenditures of about $150 million.

In the U. S., Alcoa now owns outright or has under option sufficient coal reserves in the Midwest to operate four large smelters for more than 60 years. One of the smelters, near Evansville, Ind., is under construction. Known as Warrick works, it and three additional plant sites are all on navigable streams.

Diecasting Advances, Growth in Galvanized Sheets To Aid Zinc

—J. L. KIMBERLEY

• Excellent justification can be found for immediate as well as long range optimism for the zinc industry and its principal outlets, diecasting and galvanizing.

In galvanizing, awareness of the need for preventive maintenance is growing. Galvanizing of steel to be used directly or painted is increasingly recognized as sound economy.

Within that field, the largest single growth factor is shown in American Iron & Steel Institute statistics: Galvanized steel sheets rose from 2.5 per cent of total steel shipments in 1948 to over 5 per cent in some recent months.

The Federal Highway Program, which should be well underway during 1959, will serve as an additional and substantial outlet for galvanized steel of all sorts —for guard rails, culverts, bridges, tunnels, sign posts, and lighting systems.

A further increase in the usage of zinc diecastings is strongly indicated by a perpetual market survey conducted by the American Zinc Institute with manufacturing consumers. The increased use of aluminum by the automotive industry is not significantly or permanently "at the expense of" zinc diecastings, but rather, "in addition to."

Zinc usage by the brass industry (in the form of rolled zinc, in the field of zinc anodes for cathodic protection, and as an oxide for rubber and paint) continues to hold its own. In fact, these uses are expanding with the economy and through the improvements being achieved by the technical programs of the various producers as well as by the industry-wide programs of the AZI.

Copper Demand To Rise in 1959; Availability Will Be Adequate

—CHARLES H. WINSHIP JR.

• Copper consumption in the U. S. should improve moderately in 1959 because of a more favorable outlook for new home construction, more home remodeling, expansion of electric power and communications facilities, and better demand for automobiles and appliances. A period of adequate but not excessive supply, good consumption, and reasonable price levels is in prospect.

Mine production at established properties has been increased in the U. S. and in the Belgian Congo and some new properties are ready for production.

The current price level will make available to consumers copper that for some time had been shipped to the U. S. government under floor price contracts. The British Ministry of Supply has made available to consumers in the United Kingdom 10,000 tons from its stockpile.

Consumption outside the U. S. during the last several months has been at record levels and a decided pickup in consumption in the U. S. occurred in October. Consumption abroad may not continue as high as the October, 1958, level, but no appreciable drop in the 1958 average rate appears in the offing.

Statistically, the industry's stocks of refined copper in the Free World have been reduced to a level which is not considered excessive in contrast to the situation as late as April, 1958. Some part of the current increased shipments to fabricators can be considered a buildup of inventories. In turn, some shipments of fabricated copper and copper bearing products to customers of fabricators are undoubtedly for inventory accumulation. It's more than likely, however, that inventories, particularly beyond the fabricator level, had been reduced to abnormally low levels during the two previous years of oversupply and falling prices.

Missile Research Points to Tungsten as Ultimate Material

—K. C. LI

• Accelerated searches are underway for construction materials that will allow missiles to operate with more power and velocity to reach higher altitudes. While many materials are under consideration and testing, the search usually points to tungsten as the ultimate material. Besides being the metal with the highest melting and boiling points, tungsten also has the greatest strength at high temperatures. And in spite of its high density, the strength to weight ratio of tungsten is best of all materials at high temperatures.

Yet, tungsten was comparatively neglected in the past by research and development workers. During the last year, however, intense efforts were begun to investigate the properties of tungsten for high temperature use and to develop fabricable tungsten. First, it is necessary to study in detail properties of tungsten, particularly at high temperatures. For this, highest purity material is being prepared. Data collected thus far show that tungsten has comparatively much higher tensile strength, yield strength, and modulus of rigidity than all other materials up to its melting point.

The body centered, cubic lattice structure of tungsten indicates that it should be ductile. As yet there has not been pure enough tungsten produced to be free of the influence of interstitial im-

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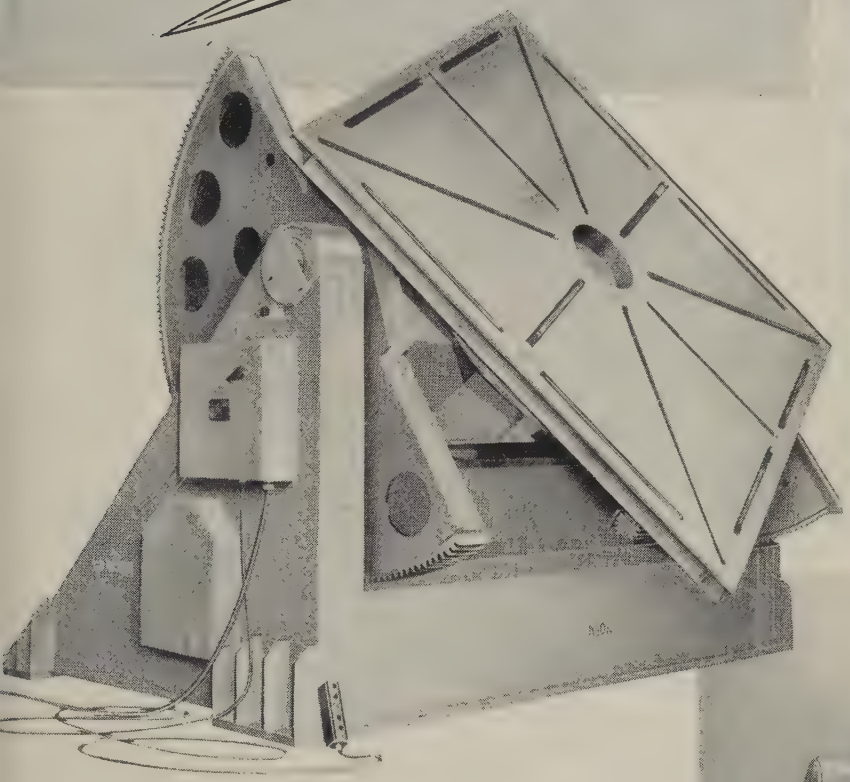

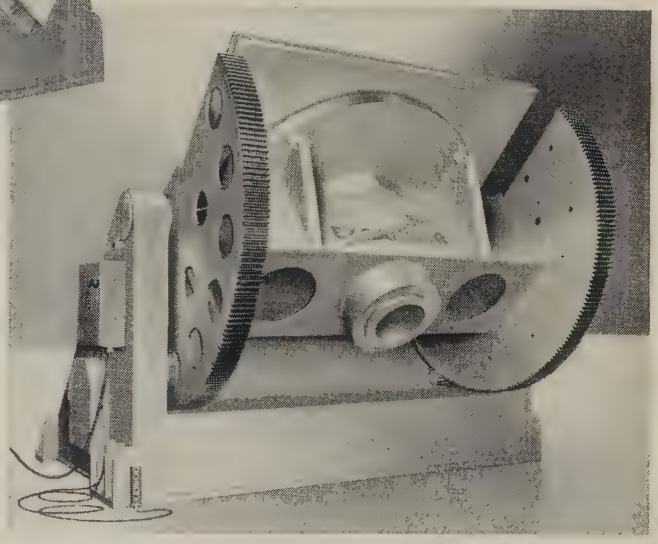

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Nonferrous Metal Production

DEREK RICHARDSON
Vice President-Aluminum Sales
Metals Div., Olin Mathieson
Chemical Corp., New York

purities. Much work is underway toward preparing the purest possible tungsten and measuring its properties.

Research Key to Winning New Markets for Aluminum's Growth

—DEREK RICHARDSON

• The need to achieve a more realistic balance between the supply and demand for aluminum has caused intensified research programs on new methods, materials, and processes aimed at the development of large tonnage applications.

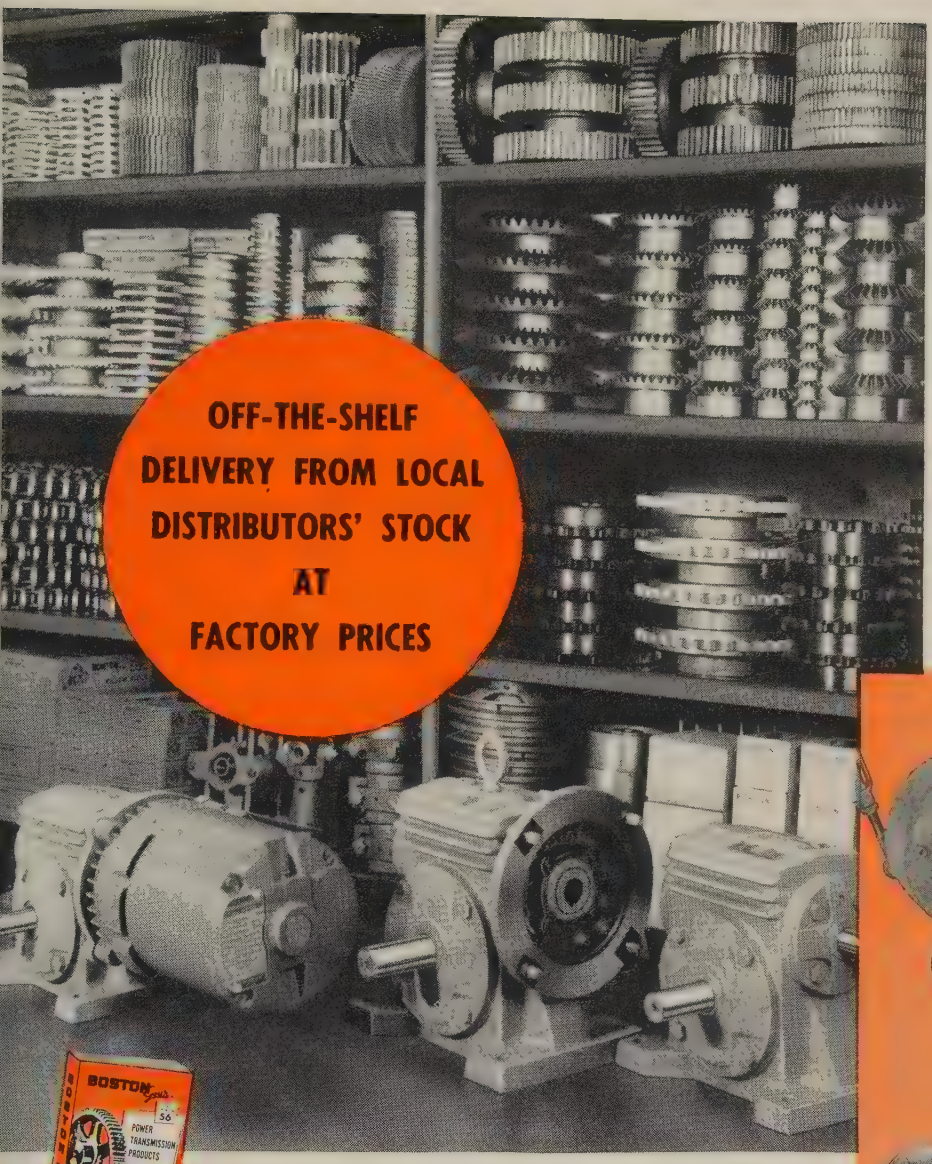
Paramount will be the development of new alloys with higher strength, better finishing and corrosion-resistant properties, and improved joining adaptability. They will allow the industry to widen existing markets and expand into new ones.

Development of improved joining and welding methods and techniques will be a major research goal. Expect an improvement in the quality of filler wire used in welding aluminum. Porosity-free weldments will expand such applications as pressure vessels, missile components, and armor plate.

Adhesive bonding and pressure welding will be used extensively to join aluminum to itself and to other materials. For example: Composite panels of aluminum sheet with any one of a number of newly developed core materials will combine lightness with high strength for numerous applications in residential and commercial building construction.

One technological problem that should receive tremendous attention shortly is the improvement of the solderability of aluminum to achieve greater penetration in the electrical industry.

Improvement in the methods of applying protective film coatings at higher speeds and lower costs is another important technological problem facing the



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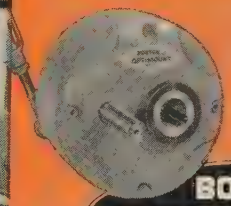

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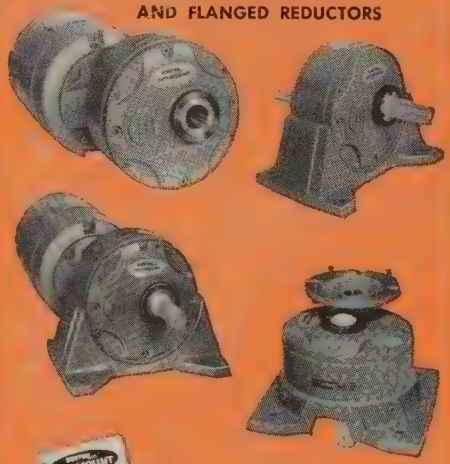

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Nonferrous Metal Production

HEINZ V. MENKING
General Director-Product Development, Reynolds Metals Co.
Richmond, Va.

industry. That would greatly expand usage in areas where corrosion is a problem.

A great need exists for the development of aluminum castings (particularly diecastings) with improved surface quality so that they can be finished by methods now used on competitive materials.

New Aluminum Uses Should Hike Sales to 4 Million Tons by '65

—HEINZ V. MENKING

• Despite a decade of fantastic growth, the aluminum industry is expected to continue expanding at a phenomenal rate. Consumption should approach 4 million tons by 1965, a growth of about 100 per cent in ten years.

Part of the metal will be absorbed by expansion of present markets. But the largest share of new consumption will be in markets recently developed by advances in technology.

Interlocking extrusions may be expected to appear in many new applications. Castings will demonstrate expanding usefulness. Development of wear resistant alloys containing silicon offers weight and cost savings for automobile brakes, industrial clutch plates and other friction applications. Vacuum diecasting of alloys will provide nonporous cast structures and smooth surfaces than can be economically brightened and anodized and that will permit thinner wall sections for pressuretight applications.

In the railroad industry, many new applications are planned. Some of them: Doors that open and close easily, floors and racks that resist wear and do not absorb moisture and odor, gondolas that resist corrosive attack and dump cleanly.

Major structures—bridges, drilling towers, and buildings—will gain in the next few years.

Photo courtesy of Jones & Laughlin Steel Corporation

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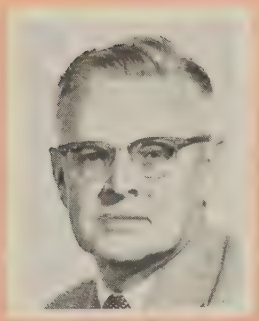
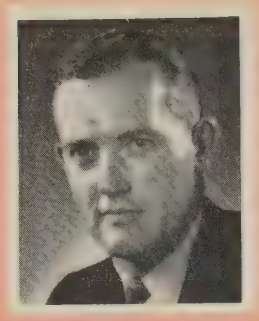


T. E. EAGAN
Chief Research Metallurgist
Cooper-Bessemer Corp.
Grove City, Pa.



G. E. SEAVOY
Vice President
Whiting Corp.
Harvey, Ill.

RAY SUTTER
President
Sutter Products Co.
Holly, Mich.

1959 FORUM ON TECHNICAL PROGRESS

Casting

Automotive Uses Spark Aluminum Castings

—D. L. LaVELLE

• Automotive applications continue to be the brightest spot in the future of the aluminum casting industry. Much development work is being done toward the use of aluminum castings for such things as cylinder blocks, cylinder heads, and brake drums. In these applications, there is considerable interest in the hypereutectic aluminum-silicon alloys, containing as much as 25 per cent silicon, because of their attractive wear resistance. But some difficult machining and casting problems must be solved before the use of the high silicon alloys becomes widespread. One car today uses front wheel brake drums (conventional permanent mold cast) which have a ferrous liner.

Diecasting continues to equal the output of all other casting methods combined and shows strong signs of continued growth. The advent of a partial vacuum in the die cavity shows promise for improved surface finish, thinner walls, and sounder castings. The use of evacuated dies should also improve the possibility of obtaining aluminum diecastings that are suitable for decorative and anodized finishes.

Sand and permanent mold casting of SG70A and SC51A is paying off. The use of higher purity plus higher alloy content, advanced foundry techniques, and unconventional heat treatments is resulting in better castings. They have higher strength and ductility than was formerly considered possible on a production basis.

Future of Gray Iron Hinges on New Methods

—T. E. EAGAN

• In many instances, the future of the gray iron foundry industry will depend on the adoption of the newer technologies. This industry is being threatened by the lighter metals, especially in small castings. A number of the castings have already gone to aluminum, chiefly on the fact that the cost of the finished piece is less than when it was made of gray iron.

The gray iron industry is well aware of this tendency. It must introduce more and more refinements in molding practice, such as the introduction of shell molding to produce castings to closer dimensional tolerances. The other effort is to produce molds at lower cost by taking advantage of processes like air-set cores or CO_2 (both molds and cores).

The water cooled cupola, with or without preheated blast, is being installed in more and more foundries. It allows melting at a lower cost.

It also allows basic or acid operation.

The brightest spot in the gray iron field is the increasing production of ductile iron. Even during the slowdown in the production of gray iron, the output of ductile iron has more than doubled each year. It will continue to do so because of the improvement in the control of castings and the education of designers.

Capital Improvements Aimed At Foundry Improvement

—G. E. SEAVOY

• The pulling in of the belt has had a salutary effect in many ways. Marginal methods, maginal equipment, and marginal manpower have been eliminated. The urge and the need to operate at a profit will encourage the adoption of ways to cut costs to be more competitive as the market expands. I believe capital goods buying will first be concentrated on the improvement of installations rather than the building of capacity.

Possible examples: Modern hydraulic controls on electric furnaces, for fast melting; water cooled, liningless cupolas with water cooled tuyeres for operation with basic, neutral, or acid slags; the addition of air preheaters for cupola hot blast; low headroom cradle type mixers for the storage of hot metal between cupolas

JAMES H. SMITH
General Manager
Central Foundry Div., General Motors Corp.
Saginaw, Mich.

D. L. COLWELL
Vice President
Apex Smelting Co.
Cleveland

J. G. RAYNIAK
President
Outboard Marine Corp.
Waukegan, Ill.

CHARLES W. BRIGGS
Technical & Research Director
Steel Founders' Society of America
Cleveland

and steelmaking furnaces and for smoothing out the variables in the metal composition; improved overhead electric cranes with new hydraulic motors and controls for more accurate positioning and handling.

Sees Bright Future For Shell Molding

—RAY SUTTER

• In shell molded castings, the foundry industry has a new tool that permits:

1. Radical reductions in plant floor space requirements.

2. Reductions in plant labor costs, both productive and nonproductive, and plant equipment costs.

3. Improvements in product quality.

Normal improvement factor gains have already been promised to labor. A distinct process change is the only method to which management can turn to allow a larger return on its investment.

We look forward to increased acceptance of shell molding. We predict that some mechanical parts not yet produced by the casting process could easily be changed over and improved upon when shell molding techniques and new metals are considered on an over-all basis.

Atomic Byproducts Have Casting Role

—JAMES H. SMITH

• During the last ten years, technological progress has provided the casting industry with new processes and controls which have enabled us to maintain a much higher level of product quality. This progress has been important, but it may seem insignificant when compared with the strides that we expect during the next decade.

We are already finding ways to utilize the byproducts of atomic energy—but have barely scratched the surface. One has been the use of cobalt 60 radiography as a nondestructive testing tool. Another has been a recent development by our experimental engineers: Using radioactive isotopes to automatically control the moisture content of molding sand—a method which appears to be vastly superior to previous methods.

We are also exploring the possibilities of using isotopes to improve the melting procedure, to improve dimensional control, and as a new inspection medium. There is a further possibility that the physical properties of metals can be increased manyfold through the use of nuclear energy—thus leading to stronger, lighter ferrous castings. In brief, the atomic age is expected to provide new tools which will lead to an unparalleled period of technological improvement in the metal casting industry.

Aluminum-Silicon Alloy Meets Engine Challenge

—DONALD L. COLWELL

• Probably the most sensational development in aluminum casting during the year has been the renewed interest in the hypereutectic aluminum silicon alloys. Means of modifying the hypereutectic alloys with phosphorus have been perfected and alloys are being tested for gas engine use. The advantages of low coefficient of expansion, good wear resistance, and good castability in sand, permanent mold or diecasting seem to make it a natural for aluminum gas engine parts, including the cylinders themselves or liners for the cylinders, aluminum brake drums, and aluminum pistons.

The use of the higher purity grades of 355 and 356 continues to expand, particularly in the permanent mold field. One producer is offering ingots with an iron content guaranteed below 0.12, obtainable by the use of special low iron grade of silicon. The principal advantage of the lower iron content is in the higher elongation obtained.

Aluminum diecasting continues to grow in popularity. With increasing volumes of household appliances, small gas engines, and automobiles, the 1959 volume of aluminum diecastings should be tremendous.

The vacuum diecasting process has not proved the panacea for all diecasting problems, but it has proved helpful in many instances, and interest in the process is keen.

Progress Is Keyed To Drastic Thinking

—JOSEPH G. RAYNIAK

• New methods, materials, or processes must come from engineering and manufacturing groups that get together and find ways to improve or produce a better product at less cost—either through better manufacturing methods or better productivity. That covers a multitude of things for every manufacturer to do because there is always a better and cheaper way to make a product.

To continue our prosperity, a lot of drastic thinking will have to be applied to correct the many things that exist today. I think every manufacturer can solve his own problems and take part in the whole program.

Steel Casting Industry Researches Its Problems

—CHARLES W. BRIGGS

• The steel casting industry is engaged in an extensive study on tolerances applicable to steel castings with the purpose of passing along industry values to purchasers.

Collective research is being carried on by the industry toward the improvement of the surfaces of steel castings. The industry has experienced some accumulations of nonmetallic, glasslike material on casting surfaces which result in casting repairs by welding. It is expected that information on the causes and production

Casting

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methods to prevent their formation will be disseminated to the industry during the fall of 1959. Incidentally, the research studies include the use of radioactive isotopes to determine the origin of the surface-included nonmetallics.

The subject of surface characteristics and inconsistencies in steel castings is being vigorously tackled and it is planned that a full set of reference photographs will be available to certain industries, especially the oil refining industry, illustrating various degrees of surface imperfections which can be employed by inspectors as visual standards.

Committee work has likewise been planned so that during 1959 reference radiographs on steel castings relating to castings of section thicknesses of 4 to 12 in. will be issued.

Steel foundries are showing considerable interest in leaded steels in casting form. Some interesting savings in machinability have been reported for lead-bearing steel castings. Interest is running high in this process and further steel foundry developments are expected in 1959.

Steel Castings Market Geared to Durable Goods

—F. KERMIT DONALDSON

• Since the end of World War II, the use of low alloy steel castings has increased from about 10 per cent of the total produced to about 35 per cent. This trend will continue as engineers are called upon to meet increased strength requirements coupled with decreased weight requirements.

The steel castings industry will have increased interest in market research and development during 1959. Concepts must be drawn of the markets of five to ten years hence based not only on physical tonnages but also on the effect of the technological changes.

Improvements in molding materials and techniques, with concommitant improvements in tolerance limits and surface finish, are resulting from research and development programs carried out over the last several years. They are placing the industry in a stronger position to compete with other methods of fabrication. These studies will be continued through 1959 and beyond.

Because of its dependence on durable goods, the steel castings industry is extremely cyclical. Operations reached a low point during 1958. The trend during the last quarter of 1958 has been upward, and based on the indicated improvement in capital spending should continue upward during the first half of 1959.

Diecasting Heads for Growth With Aluminum as Star

—A. F. BAUER

• For the first time in the history of diecasting, equipment has been enlarged so much that there is actually no limitation to the size or weight of diecastings.

This year and those to come will bring a continuation of the rapid growth of aluminum diecastings. The first one-piece transmission case in aluminum diecasting was so successful and showed such large savings that all the automotive companies are designing their transmission cases exclusively in aluminum. These transmission cases alone may increase the consumption of aluminum diecastings by 40,000 tons a year.

The developement of engine blocks in aluminum diecastings is somewhat slower, because of the basic problems involved in the use of aluminum. The main problems are a proper cylinder bore material or coating to overcome the low wear resistance of aluminum, and the search for a crankshaft bearing design which will compensate the higher coefficient of expansion of aluminum. It can be expected that the first 6-cylinder engine blocks in aluminum diecasting will be produced in 1959, but mass production will not start before 1960 or 1961.

The coming years will also bring more automation in the diecasting process. Automatic ladles, a must on large diecasting machines, will be favored more and more on medium size machines to reduce operator fatigue. Cost reduction and greater uniformity of the quality of diecastings will be achieved by gradually eliminating the variables caused by the manually controlled portion of the casting cycle.

For the years ahead, the increase in diecasting consumption will continue in the well-established diecasting alloys, zinc, aluminum, and magnesium. With large marked potentials for transmission cases, bimetallic wheels and, perhaps, engine blocks, already established, aluminum diecastings will show by far the largest growth. Total aluminum diecasting consumption will more than double and pass the 1 billion lb mark during the next three to five years.

It is expected that diecasting consumption in the coming years will far surpass combined consumption of sand and permanent mold castings.

Investment Casting Eyes Critical Jobs

—THEODORE OPERHALL

• The demands of Mach 3 aircraft, missiles, and space age vehicles are posing new problems for the investment casting industry. Many new alloys are being developed for jet engine turbine blades that will require 100 hour qualification at a temperature of 1800° F and stress levels of 20,000 psi.

Alloys such as U-500, U-700, 713, Nicrotung, and WI-52, exhibit their best properties when poured from vacuum primary ingots and vacuum cast.

To permit greater latitude in design and to improve quality of the product, we have seen the introduction of the ceramic shell process. These new techniques have promise of providing new fields of application because the shells

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Casting

CHESTER V. NASS
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Foundry Engineer, Magnesium Products
Dept., Dow Chemical Co.
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HARRY M. ST. JOHN
Foundry Consultant
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HANS J. HEINE
Technical Director
Malleable Founders' Society
Cleveland

are produced by a series of dipping operations which avoid many of the problems common to the old type monolithic mold.

In the field of structural airframe components, our industry has yet to provide the product demanded by the user. But the problems are great because quantities are low, the components complex. Their varied section size require Zyglo, x-ray, and surface qualities near perfection.

The shell process may provide many of the solutions to the difficulties encountered with the conventional investment process. Here again we must anticipate the needs. A technique must be developed which may be a modified ceramic shell process. It will probably be a cope and drag system capable of being preheated to elevated temperatures so that thin sections can be filled, and it must be free of organic materials after firing because it is likely that the components will be poured in a vacuum furnace.

Foundries To Seek Efficiency Through Latest Improvements

—CHESTER V. NASS

• With the economy of the country in a definite upswing, the foundry industry, after a more prolonged period of decreased activity than was predicted, is setting its sights for the increased business ahead.

Improved production, improved quality product, and in-line costs must be the immediate goal of the foundry industry. The costs of labor, our most expensive commodity, will continue to increase and the so-called improvement factor, demanded by labor as an annual increase, has in fact become a pattern. Foundries cannot continue to pay this without having the advantage of it, and this can be attained only by improved production through new processes, new methods, up-to-date equipment and modern controls.

New, efficient, low-cost sand reclamation is providing opportunities for cost savings not before attainable. Improved, yet simplified, controls are being provided for practically every phase of the processing of materials for and the actual making of all types of castings.

Engineering Successes Point To More Magnesium Castings

—M. E. BROOKS

• Two significant trends in magnesium sand casting will probably continue for several years to come.

First, the type of castings being made is changing. Fewer heavy-walled aircraft wheels and engine castings are being designed. More thin-walled parts are being cast for engines, control mechanisms, and a variety of other functions in aircraft and missiles.

A second trend is toward the increased use of alloys possessing superior elevated-temperature properties. In addition, magnesium alloys with higher room-temperature properties have been developed.

Another significant development is the use of a new high damping magnesium alloy, both sand cast and diecast, in electronics equipment requiring exceptional vibration resistance.

Shell cores are being used increasingly in both sand and permanent mold castings. CO_2 cores have brought closer dimensional tolerances while waterless molding sand has improved surface finish.

Successful engineering of many magnesium automotive applications in the past indicates that die and permanent mold castings of this metal will be used at many times the present volume in future automobiles. The development of a magnesium cold-chamber diecasting process with metered automatic feed shows promise of improving the production economics of this metal and should enhance the position of magnesium diecastings in all markets.

Brass and Bronze Castings Keyed to Modern Practice

—HARRY M. ST. JOHN

• Molding sand technology has reached a point where one thing seems fairly clear. Naturally bonded sand in its natural state can no longer be considered adequate. New sands must be blended with one another and with reclaimed sands. Bonds must be added in proportions carefully calculated to produce a desired result. Some additives, such as wood flour, have proved their usefulness. Certain chemical additives are promising. Sand mixtures need to be tempered and conditioned and their finished properties tested before use. Automatic sand conditioning systems are costly to install and maintain. They are justified only when much labor can be saved. The small foundry will tend to use facing sand, with cleanliness and physical properties closely controlled.

Automatic molding has not reached a point where it is suitable for the small foundry, but considerable improvement can be made in the mechanical handling of molds and castings. Harder molds and patterns designed more closely to finished dimensions will result in less machining and less nonproductive metal in the form of machine turnings.

Look for Ferrous Castings Cast Directly from Ore

—HANS J. HEINE

• The revolutionary tendency to locate foundry facilities close to aluminum reduction plants may well usher in a dec-

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This year of 1959 is the Golden Anniversary of Wisconsin Engines. It heralds 50 years of continuous engine progress. Fifty years of engineering development and exclusive specialization in the design and manufacture of engines.

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- Originally manufactured in a power range up to 200 hp., Wisconsin Engines helped to make automotive history as well as supplying dependable power for many industrial applications — service that called for the most advanced engineering.
- Heavy-duty design and construction and High Torque performance have been traditional features of *all* Wisconsin Engines. You get longer life from Wisconsin Engines and lowest cost maintenance.
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- More than 2000 convenient Wisconsin Authorized Service Stations stand ready to provide expert servicing and factory-built parts for all Wisconsin Engines.

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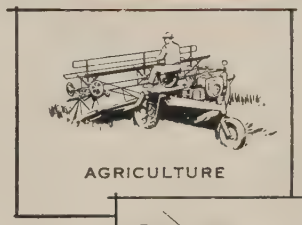
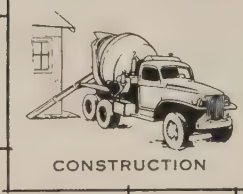
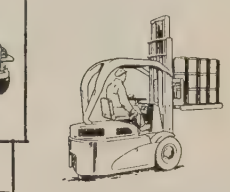
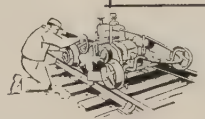
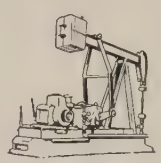


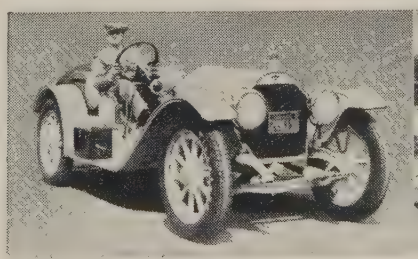




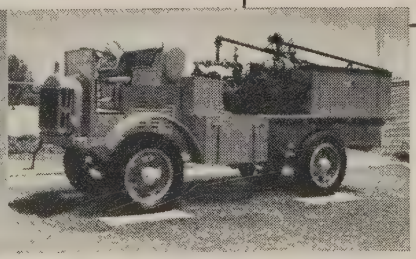




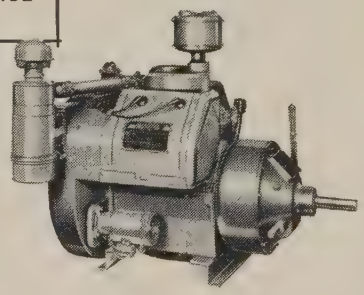
from water-cooled Automotive and Industrial Engines, to WORLD LEADERSHIP IN THE MANUFACTURE OF HEAVY-DUTY AIR-COOLED ENGINES for all types of power service.



This 1914 Stutz Bearcat, one of the most famous and rugged cars of its day, was powered by a Wisconsin Heavy-Duty Water-Cooled Engine . . . a power leader of high recognition even at that early date.



This FWD Wisconsin-powered truck, known as "No. 28," was purchased in 1921 from Army Surplus, and after many years of service is now on display at the Halliburton Oil Cementing Co., in Oklahoma.



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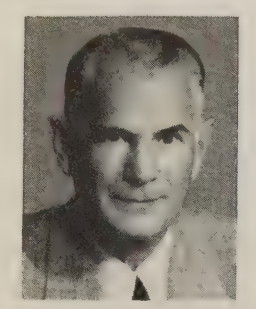

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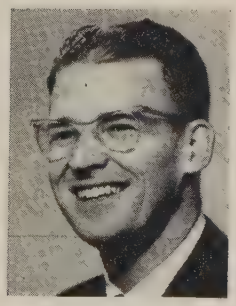
Vice President and Gen. Mgr.
Stewart Die Casting Div.
Stewart-Warner Corp.
Chicago

W. E. SICHA
Chief, Alcoa Research Laboratories
Aluminum Co. of America
Cleveland



EINAR A. BORCH
Executive Vice President
National Metal Abrasive Co.
Cleveland

ade of spectacular progress for the casting industry. A corollary will be developed for the ferrous foundries; in fact, it may eventually become a question of primary importance for the producers of malleable iron components. Recent developments indicate that the production of ferrous castings directly from ore may be a reality—several methods are in pilot production in England and on the continent.

Metallurgical developments, such as economic direct reduction, will be followed by expanding markets for the malleable casting industry. Looking beyond the age of the jet propelled airplane, we envision the use of an atomic powered air vehicle. Since weight will then no longer be of primary importance, ferrous castings will come into their own. More extensive use of malleable iron as a material of construction is also in prospect for ground equipment.

Research on hot pressing could lead to malleable castings with close dimensional tolerances. The parts will be free from residual stresses, since the pressing is done at temperatures where stresses are relieved.

Looks for Much Activity In Casting Research

—L. G. VANDERHOFF

• We look forward to '59 as a formative year, with considerable enthusiasm for process and material developments of major importance.

Progressive developments toward further automation of our highly productive equipment already show great promise in field tests. This year could well be most eventful in the direction of solidifying fully automatic machine designs of wide operational scope and improved vacuum casting techniques.

To meet the needs of modern technology, national task groups of engineers are busily engaged in many processing projects. Our industry activity in research seems well on its way toward establishing fixed yardsticks of processing controls.

Diecasters Eager To Get Going On Proposed New Applications

—W. E. SICHA

• The already publicized interest of auto manufacturers in aluminum cylinder blocks and cylinder heads certainly will have an impact on the aluminum casting industry. Decisions apparently still have to be made in attaining a compromise between cylinder block design and casting process to obtain the most economical finished and installed cylinder block. Active consideration is being given to aluminum-silicon alloys containing from 15 to 25 per cent silicon for cylinder block production to gain improved resistance to wear. Spray coating of the hypereutectic aluminum-silicon alloys on the cylinder walls of blocks, cast of an established commercial aluminum alloy, is receiving attention as an alternate approach. More extensive use of aluminum brake drums and transmission housings also can be expected.

Pumping of molten aluminum from the melting furnace to the mold offers potential advantages and has been under investigation for many years. The major problem has been finding suitable materials for pump components and piping that would not be attacked by the molten aluminum. Further work on materials will be required to learn whether pumping will be economical.

The highest degree of interest in premium strength castings has been displayed by aircraft frame manufacturers. Greater use of such castings should develop in aircraft frame construction, and also in other applications where the higher tensile properties will permit weight reduction. Castings conforming to closer dimensional tolerances than those previously established for commercial castings are available.

There is evidence of a market for ornamental castings anodically coated to provide bright and colored finishes.

Modernization Cited as Today's Biggest Need in Foundry Field

—EINAR A. BORCH

• In the years immediately ahead, technological improvement of equipment will continue the fast pace of the last decade. However, greater emphasis will be placed on design and engineering development of features tailored particularly for the medium to small foundry operation, giving recognition to the modernization needs of the approximately 80 per cent of foundries with employment under 100.

Equipment sales in 1955, 1956, and 1957 stemmed primarily from expansion needs of the large foundry operator. Total foundry capacity doubtless is more than adequate for projected production requirements for several years ahead. Replacement and modernization is the big need of the foundry industry in 1959 and 1960.

An even greater challenge exists, however, within the foundry industry: It is the need of economic and financial improvement so the industry can avail itself of the technological improvements present in up-to-date foundry equipment.

The bulk of all capital equipment expenditures stems from retained profits and from depreciation reserves. Profits of the smaller foundry have been extremely low, or even nonexistent, since mid-1957. In addition, few, if any, foundry operators actually fund, or even earmark, depreciation deserves for future equipment replacement. Instead, the reserves are absorbed into working capital.

Perhaps the greatest challenge before us is that of joining with other industries in a renewed effort to reform present depreciation handling in our tax structure. Perhaps, too, such reform should contain a built-in self-protection feature assuring that the full benefits of tax relief afforded through depreciation reform can be realized only if depreciation reserves accumulated on equipment are used for eventual equipment replacement.

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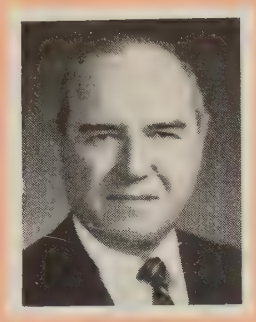
WALTER E. JONES
Vacuum Melting Section
Metallurgical Products Dept.
General Electric Co., Detroit



T. W. GABRIEL
Vice President—Commercial
Jessop Steel Co., Washington, Pa.

CARL B. POST
Vice President & Technical Director
Carpenter Steel Co., Reading, Pa.

WALTER L. FINLAY
Director of Research
Crucible Steel Co. of America
Pittsburgh

1959 FORUM ON TECHNICAL PROGRESS

Materials and Metallurgy

Changes in Vacuum Melting May Reduce Alloy Costs

—WALTER E. JONES

• We feel that the induction vacuum melting is the true specialty metal process. It has made possible full scale production of completely new alloys and families of metals that cannot be made any other way.

Production capabilities are well determined. One of the newest alloys, Rene 41, has surged from the laboratory-pilot plant stage to commercial production in less than a year.

The years immediately ahead should see some important changes in vacuum melting. One necessary change will be closer control of the molten metal in relation to the finished part. The billet will be not a preparatory step to later forging but will give way to a semi-finished part with tolerances reasonably close to the item as used in production.

Part of the technological problem is the ability to predict and adjust the internal structure of the molten metal before, during, and after solidification. Once it is licked, the possibilities of extending the use of the vacuum melted alloys will be unlimited.

Castings with high fatigue strengths and combinations of good mechanical properties will replace the more expensive forgings; materials will be cast much closer to final size, as in the case of sheet slabs or the continuous casting of hot strip. The direct result of this cost saving will be the availability of high performance, high strength materials within the direct reach of everyday applications.

Metal Requirements Changing, Producers Need New Methods

—T. W. GABRIEL

• The greater cleanliness requirements and higher physical properties needed by metals at elevated temperatures have put a premium on metallurgical and development research.

At the same time, the concept of long-time physicals has changed to high physicals at high temperatures for periods measured in minutes. The exclusion of tramp elements and gases in even minute quantities has grown in importance as we learn more about residual effects.

Those indications point to a new era in specialty steelmaking over the next decade. It will require applications of new production methods and equipment, as well as new means of physical and chemical testing.

A continuing growth market for stainless, alloys, tool steels, and superalloys is indicated by these specialized demands. The new requirements will be superimposed on an expanding market for the less romantic but more normal and steady need of these grades for domestic and industrial uses.

Coming Products Will Use More Vacuum Melted Alloys

—CARL B. POST

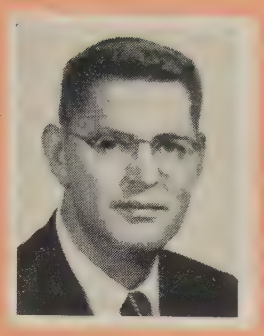
• This year we will see a rapid expansion in vacuum induction and consumable electrode melting. The greatest increase will come in the manufacture of high temperature materials and other alloys requiring a more consistent product and less scatter in physical properties.

Vacuum melting processes will also be applied more extensively in atomic energy, where one component failure can ruin a multimillion dollar installation. More steel for critical machine tool parts will be vacuum melted, especially where they are involved in an automated setup, the failure of which can shut down an entire assembly line.

Welded stainless steel tubing will find more application in the electrical power generating industry. It is already beginning to displace certain forms of admiralty metal tubing in heat exchange applications.

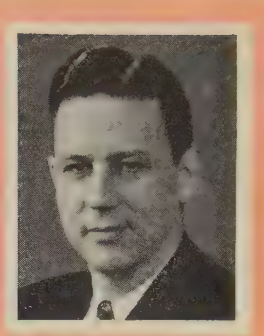
Improved methods of welding and fabricating welded tubing have enabled the formed steel tube industry to meet the

W. B. PIERCE
Vice President in Charge of Sales
Allegheny Ludlum Steel Corp.
Pittsburgh



WILBUR T. BOLKCOM
President, American Metallurgical
Products Co. Inc., Pittsburgh

J. H. BECHTOLD
Manager, Metallurgy Dept.
Westinghouse Electric Corp.
Pittsburgh



M. J. DAY
Vice President—Technology
Crucible Steel Co. of America
Pittsburgh

most stringent requirements. To keep up with demand, our own tube division as well as those of other producers will make products in a growing variety of modern alloys, including high temperature alloys, exotic metals, and stainless steels for severe corrosion resistance.

Magnetic alloys such as HyMu 80, a 79 per cent nickel-iron-molybdenum alloy, and High Permeability 49, a 49 per cent nickel-iron alloy, will come into greater use by the electronic industry this year.

High Strength Titanium Alloys Will Be Evaluated This Year

—WALTER L. FINLAY

• The most noteworthy titanium alloy development last year was the introduction of three Formageable (formable in the soft condition, ageable to high strengths) titanium sheet alloys, including the first beta titanium alloy, B 120 VCA.

With development sheet samples exhibiting strengths exceeding 250,000 psi, B 120 VCA has among the highest (perhaps the highest) strength-weight value of any structural metal sheet. It is expected that B 120 VCA, and the other Formageable titanium alloys, will be extensively evaluated for advanced aircraft and missiles this year.

Another significant 1958 titanium development of growing importance in civilian markets for 1959 and future years: An extremely thin (a few millionths of an inch) coating of platinum on titanium gives titanium the better corrosion resistance of platinum even though the coating is not continuous.

Outlook for Stainless Good; More Nickel Is Bright Spot

—W. B. PIERCE

• This year could see the start of a new upsurge in growth for stainless.

Flat-rolled capacity has been substantially increased with the startup of new mills, particularly Sendzimirs. New bar mills and forging presses also have increased the industry's capacity for producing stainless and alloy bars, rods, and wire.

Another encouraging element in the outlook is the increased availability of raw materials, notably nickel. Producers of nickel and other raw materials are already stepping up their sales promotions.

Basically, we look for growth of stainless to come from steady improvement and extension of present markets, not spectacular new applications.

Perhaps the most interesting of our market opportunities is the missile field. Still in development stage, with rapid changes in design, this market will continue to test the skills of the makers of special steels. We are alert not only to new uses for stainless but also for the vacuum melted, high temperature alloys for tool steels and certain low alloys processed to missilemakers' specifications.

Cerium-Containing Solders Boost Auto Radiator Life

—WILBUR T. BOLKCOM

• We anticipate a major development in the use of solders in the metalworking industry during 1959. The key to this technological breakthrough is the rare earth metals.

A controlled research project (at the Battelle Memorial Institute, Columbus, Ohio) showed that the life of an automobile radiator could be increased five or six times by using a solder containing 70 per cent or more of tin with certain additions of cerium. The cerium was used both in its isolated state and in the form of misch metal containing about 50 per cent cerium.

We have learned through research that misch metal is at least comparable—and sometimes superior—to the isolated and more expensive cerium in joining stainless, low alloy steels, iron, aluminum, and brass.

Future Alloys Will Come from Tungsten, Tantalum, Rhenium

—J. H. BECHTOLD

• The quest for materials for use at ever higher temperatures will focus the attention of many metallurgists on alloys of the three highest melting point metals —tungsten, tantalum, and rhenium.

From those elements, all of which melt above 5000° F, will be developed the alloys which will support the highest loads at the highest possible temperatures (2500° F and up) achievable with metals. The problems to be solved are formidable, but the potential rewards are equally great.

Research during the last decade on molybdenum and more recently on columbium has resulted in the development of a number of strong and useful high temperature alloys which are beginning to become important in aircraft and missile components.

The mill products of those alloys are still not fully satisfactory and improved techniques are needed for melting, forging, and rolling. Forming, joining, and coating problems that arise in applications in engineering structures must also be solved.

New Superalloys Coming, Refractory Metals To Grow

—M. J. DAY

• Rapidly expanding technology with regard to oxidation and corrosion resistance at elevated temperatures will provide new metals and alloys for the demands of the rocket, missile, and space vehicles under development.

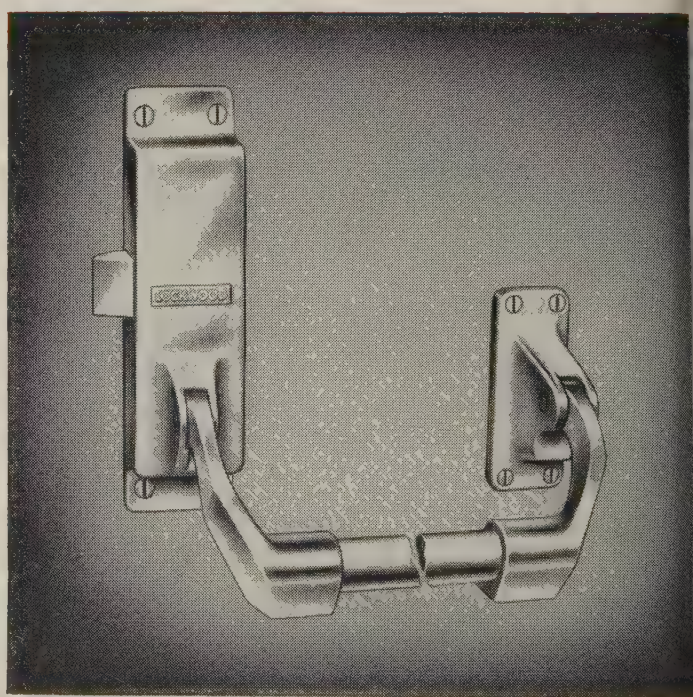
New or improved superalloys will appear. The so-called refractory metal group (molybdenum, tungsten, columbium, vanadium, beryllium, tantalum, etc.) will progress from research and development to varying degrees of commercial production. New, important applications of a military

(*Please turn to Page 246*)

Fire!

. . . and USS American Music Wire

CRUCIAL. In the hands of a skilled workman the vital spring goes in place in the Lockwood "Lock 'n Roll" panic exit device. In times of emergency and panic the lives of thousands of people depend upon the unfailing action of this little spring.



EVER READY to release and open the door at the lightest touch. Held in place in the "Up" position by the spring of USS American Music Spring Wire, this panic latch will open easily, smoothly at the touch of a finger tip.

CROWDS of children leaving a burning school—their safety depending upon the open door and on the smooth, perfect operation of the panic opening device. Latches of this kind are designed to meet and pass a supreme test of efficiency—a test they will probably never need to undergo. But should an emergency occur, the latch must operate completely and perfectly.

Because this "Lock 'n Roll Latch" panic exit device serves so vital a purpose, because it must give long, unfailing service, must open easily, instantly every time it is touched, the Lockwood Hardware Manufacturing Company, Fitchburg, Mass. spares no effort in design, manufacturing and selection of material to make this latch as perfect as possible.

For the latch to operate properly, the cross bar must remain in the "Up" position, ready to release the door at the lightest touch. To hold the bar in this position is the job of a very vital, specially designed spring—made of USS American Music Spring Wire.

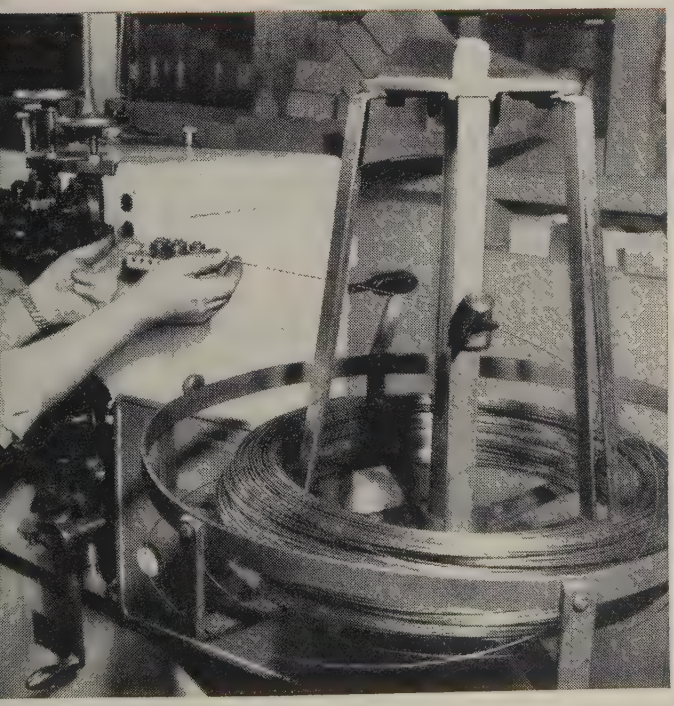
In their search for a wire to make the spring for the panic exit device, the Lockwood Hardware Manufacturing Company selected USS American Music Spring Wire for its complete dependability, its consistent uniformity and its superior quality. The experience gained in 125 years of wire drawing and manufacturing has stood American Steel & Wire in good stead in supplying the high-quality Music Spring Wire required by the Lockwood Hardware Manufacturing Company.

If you have a product involving the use of spring wire or any other type of wire, get in touch with American Steel & Wire. The same controlled quality, dependability, and uniformity are available to every fabricator who uses USS American Manufacturers Wire in the products he produces. Just write to American Steel & Wire, 614 Superior Ave., N.W., Cleveland 13, Ohio.

American Steel & Wire Division of USS United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors • Tennessee Coal & Iron Division, Fairfield, Ala., Southern Distributors • United States Steel Export Company, Distributors Abroad

makes sure the door opens!

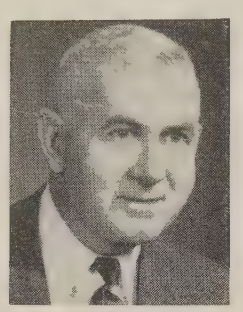


8,000,000 A MONTH. Shown here USS American Music Spring Wire is being fed into a Sleeper & Hartley spring coiler. The Lockwood Company uses ten spring coilers and one torsion machine to produce the 8,000,000 springs they use a month.

INSPECTION. Important final inspection for Lockwood spring assures that this spring will have the necessary dependability and reliability to meet the rigid requirements of a panic door exit device used on schools and other buildings.

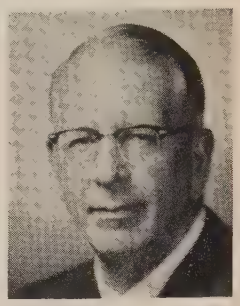
Materials and Metallurgy

WALTER E. FROEHLICH
Vice President, Associated Spring Corp., Bristol, Conn.



F. L. LaQUE
Vice President, International Nickel Co. Inc., New York

GEORGE A. ROBERTS
Vice President—Technology Vanadium-Alloys Steel Co. Latrobe, Pa.



C. L. HARDY
President, Joseph T. Ryerson & Son Inc., Chicago

and commercial nature will be found for titanium, zirconium, and their alloys.

Radical changes in primary methods of metal manufacture, by minimizing the conversion steps from raw material to finished product, are anticipated. Expansion and improvement of new techniques in melting procedures, such as vacuum melting and degassing, gaseous and liquid protective blankets, levitation and electron beam melting, will result from technical and scientific efforts for highly specialized requirements.

Problems will be development of adequate equipment for sizes and tolerances required and effective use of electronic calculators and similar equipment to accomplish goals with a minimum of time and effort.

Springmakers Need Help From Material Suppliers

—WALTER E. FROEHLICH

• This will be one of the major years for contributions to precision spring progress in the "soaring sixties."

The spring industry needs better materials, better knowledge of methods and processes, and better knowledge of spring design.

Material requirements include better surface finish, closer tolerances with less variation, and better fatigue properties. Better materials for use in wider temperature ranges (minus 100 to plus 1500° F) are needed.

In the area of improved methods and processes, spring manufacturers are faced with increasing labor costs. This is partly offset by technological improvements, but we need further improvement. The springmaking equipment builder has a definite obligation in that area.

Progress in the spring industry is pretty much controlled by the supplier of materials. To satisfy his customers' needs, the spring manufacturer must at all times work closely with his material supplier. The spring designer, whether in a springmaking or spring using organization, should understand and appreciate these problems. He can be of extreme help in this area.

Major Uses for Nickel Being Developed in Many Fields

—F. L. LaQUE

• Progress in the "soaring sixties" will depend in large degree on advances in the properties and utilization of metals. We can anticipate continuing challenges to the metallurgists to come up with even more rugged products.

Nickel will continue to make its contribution, both as a base for alloy building and as a potent enhancer of the properties of other metals. With the ample quantities guaranteed by the new nickel production facilities that will come into operation in the sixties, there should be no question of supply to restrain the advantageous use of the metal.

We can anticipate important additions to the list of major uses of nickel, such as in nickel cadmium batteries, automotive gas turbines, devices for converting salt water into fresh water, nuclear powerplants, equipment for transportation and storage of liquefied gases, structures and vessels made of heat treated alloy steels in plate forms, plants for generating steam at supercritical temperatures and pressures, and equipment for heating and cooling living quarters by electrical devices.

Steady Growth Seen for Vacuum Consumable Electrode Steel

—GEORGE A. ROBERTS

• Advances during 1959 in specialty steels, it is predicted, are specifically related to quality rather than quantity.

Special steels are being rapidly developed for high temperature applications in aircraft and missiles. The temperatures under consideration are frequently in the range 400 to 1300° F.

Alloys of the austenitic and precipitation hardening categories previously developed for applications at elevated temperatures, even beyond 1300° F, are not applicable. The demand is for high strength and high wear resistance in these areas that require martensitic, hardenable materials with a high resistance to temperating or softening.

A second need will be met by the continued expansion in the use of vacuum melted steels. A steady growth in the quantity of steels melted by the vacuum consumable electrode process is anticipated. This anticipation is based on more favorable economies in certain instances and on the fairly sound technical belief that such steels can continue to be improved as vacuum melting equipment, especially designed for steelmaking purposes, is brought into production.

New Tools Will Cut Peaks, Fill Valleys in Inventories

—C. L. HARDY

• The problem of smoothing out severe inventory fluctuations and lessening the wide fluctuations in industrial production rates is common to most types of industry.

The steel industry is more fortunate than most because it has fewer levels of distribution. Although the general line industrial steel warehouses serve to reduce fluctuations by pooling the inventory requirements of a broad group of customers from diverse industries, they too are confronted with the problem.

Improving the condition depends on better controls. Faster order handling and communication offer a possibility of

Cold Rolling Puts a Tougher Face . . . on an "Old Salt"

To increase fatigue resistance, endurance limit and to fight the corrosive action of the sea, Erie Forge & Steel technicians cold roll ship's tail shafts as illustrated above. The life of the forged steel tail shaft is prolonged by cold rolling under the propeller and the after bearing. The surface toughness thus effected reduces fretting corrosion, minimizes pitting, costly failures and the hazard of propeller loss at sea.

Cold rolling is applied not only to new shafting but also for reconditioning existing ship's shafts, thus saving sizeable replacement costs in many instances.

Designed and built by Erie Forge & Steel engineers, the machine cold rolls shafts of any length and up to 30 inches in diameter. Any desired pressure up to 37,000 pounds can be exerted by the hardened steel rollers on each side of the shaft.

The Society of Naval Architects and Marine Engineers recommends that all ship's propeller shafts be cold rolled as a safety measure. This cold rolling process is approved by The Bureau of Ships, United States Navy.

Another of the special services characteristic of the continuing progress in steel improvement at Erie Forge & Steel. Let us work with you on your steel forging and casting requirements.

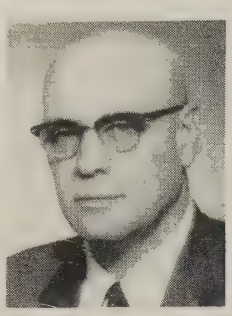
ERIE FORGE & STEEL CORPORATION

ERIE, PENNSYLVANIA

MEMBER AMERICAN IRON AND STEEL INSTITUTE

Materials and Metallurgy

N. W. BASS
Vice President, Brush Beryllium Co.
Cleveland



W. C. CLEMENTS
Metallurgical Engineer
Bethlehem Steel Co.
Bethlehem, Pa.

MILO J. MARSH
Executive Vice President, Ohio Rubber Co., division of Eagle-Picher Co., Willoughby, Ohio

CHARLES E. NELSON
Technical Director, Magnesium Products Dept., Dow Chemical Co.
Midland, Mich.

reducing the lag. Better sales data and better usage of forecasts are requirements for improvements.

Some of the tools for making progress in this area are the new developments in data processing, the new concepts of decision making, the techniques of simulation, and the theory of information feedback systems.

The manager of the future will be concerned not so much with day to day crises as with the establishment of policies and plants that minimize emergencies. He will recognize the ebb and flow forces which interact to generate fluctuating economic conditions. He must learn to appreciate the power of the new tools and encourage the development of men within his organization who can use them.

Aircraft and Nuclear Uses Boost Beryllium Consumption

—N. W. BASS

• Interest in beryllium for advanced high speed aircraft, missiles, and outer space vehicles advanced at an accelerated pace during 1958.

Applications of current interest include inertial guidance gyro and gimbal parts, missile nose cones and other re-entry components, aircraft brake discs, and airframe and structural parts of hypersonic aircraft and missiles.

While beryllium is sufficiently ductile for many applications, it would be desirable in some to have an improvement. Considerable development effort, both industry and government sponsored, is in progress.

Intensive development work in other areas of beryllium technology is also underway. They include rolling, forging, extrusion, composite bodies, missile structures, crack propagation, joining, and casting. Industrial health and safety aspects are also being investigated.

In addition to its airborne uses, substantial quantities by beryllium continue to go into nuclear applications. Intensive interest in the possible use of the metal as the fuel element jacket in gas-cooled power reactors has been evidenced in Great Britain and elsewhere.

Requests for Special Material Properties Reported on Increase

—W. C. CLEMENTS

• It is becoming increasingly necessary that all information on the end use of a material be made available to the producer.

Most consumers of steel are becoming more specific in their requirements for special material properties. Their requests demand a better understanding and evaluation of such features as composition of the material, surface and internal characteristics, as well as inherent grain size, structure, and what properties may be developed by heat treatment.

Steel designed for a specific application is a commodity. The unique properties of each commodity are developed by employing a combination of compositions, qualities, and specific manufacturing or processing practices. The details of manufacture may vary with different producers, but the characteristics of the finished material must be such that the product satisfactorily fulfills the application or end use requirements.

To obtain such information, many steel producers employ large staffs of specialists who are familiar with manufacturing procedures of the supplier and the consumer. Those metallurgists are technically trained experts with many years of experience. Their services are generally available to most consumers upon request, and the use of their special talents has proved extremely beneficial to all concerned, customers as well as steel producers.

Improved Rubber Materials Will Upgrade Metal Products

—MILO J. MARSH

• Use of rubber and rubberlike materials by the metalworking industry is expanding rapidly. The increase is sparked by new and improved materials and methods which greatly expand the range of applications, and by changing design concepts.

A significant trend in machine design is reduction of noise and vibration far below levels which were considered acceptable. It is becoming of increasing concern to manufacturers of machine tools, metalworking and printing presses, and office machinery.

Among the new materials, urethanes are assuming a major position among elastomers. They are tough, abrasion resistant, and they absorb vibration.

Processing developments include new bonding techniques and materials which expand the choice of elastomers and metals (and plastics) which may be bonded together. An example, now in mass production, is a metal gear bonded to a rubber torsion member which in turn is bonded to a nylon gear.

A market now assuming major proportions, and holding great future promise, is the production of rubber or vinyl sealing strip for curtain-wall buildings. Another development, still under investigation by the automotive industry, is the use of urethane material in new types of front-end suspension systems, offering the possibility of suspensions good for the life of the car without lubrication.

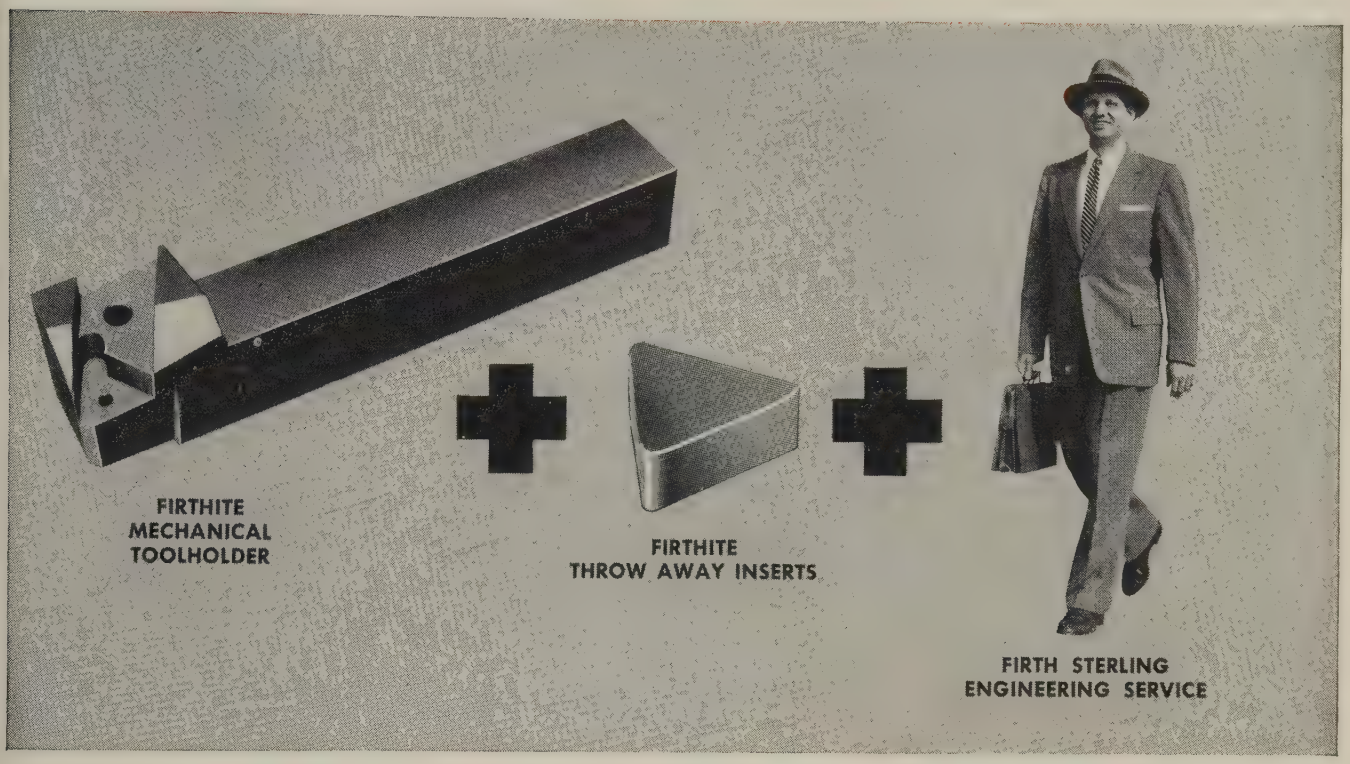
Magnesium Wonder Alloys Will Reach Market This Year

—CHARLES E. NELSON

• Watch cold-chamber diecasting with metered automatic feed. It probably is the magnesium process that will have the

Firth Sterling ...

PIONEER IN POWDER AND MOLTEN METALLURGY



TOOL UP FOR ECONOMY

with this cost-cutting combination

There are two important reasons why thousands of metalworking plants are cutting costs with Firth Sterling mechanical toolholders, throw away inserts and engineering service. First, the broad experience and expert application knowledge of Firth Sterling engineers (yours at no cost) help you plan your tooling program for maximum savings. Second, in this complete line, Firth Sterling has toolholders and inserts—*exactly* right for *your* job:

THRIFTOOL—lowest cost toolholder made. Offers chipbreaker, rigid insert and rapid indexing for reduced set-up time.

ECONODEX—medium priced holder is ideal for jobs requiring positive rake. Carbide anvil and carbide chipbreak clamp assure long life.

MECHANIDEX—for heavy-duty machining. Adjustable chipbreaker offers extreme versatility, allowing top and bottom indexing of inserts.

FIRTHITE INSERTS—most precise dimensionally—are available in a full range of Carbide grades and the new Firthite Cermet WF Grade. *Now available for the first time, high speed steel throw away inserts in two of Firth Sterling's top cutting grades—Circle C and Van Chip.*

To get help with *your* tooling problem from a Firth Sterling engineer, simply call your nearest Firth Sterling sales office or distributor. And for further information on Firth Sterling toolholders and inserts, write for descriptive bulletin MTI-3: FIRTH STERLING, INC., Dept. 81-A, 3113 Forbes St., Pittsburgh 30, Pa. Offices and warehouses in principal cities.

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FIRTH STERLING TRADE MARK

Materials and Metallurgy

EDMUND M. VELTEN
Technical Director, Beryllium Corp.
Reading, Pa.

J. S. RODGERS
Technical Manager, New Products Div.
Wolverine Tube Div., Calumet
& Hecla Inc., Allen Park, Mich.

RALPH L. WILSON
Director of Metallurgy
Timken Roller Bearing Co
Canton, Ohio

JOHN R. WILLARD
Manager, Sales Development Div.
Aluminum Co. of America
New Kensington, Pa.

biggest impact on industry in the next year or two. Now being evaluated in the automotive and electrical industries, it offers higher production rates and improved quality.

A substantial program of alloy development is in progress. Magnesium ZE10A, a sheet and plate alloy that does not require stress relief after welding, was recently put on the market. Scheduled for release in coming months are a new diecasting alloy for elevated-temperature applications, an aircraft sheet alloy with improved room temperature properties, and a sand-casting alloy with a good combination of room-temperature yield strength and elevated-temperature properties. Work continues on new families of alloys that will be compatible with each other and easier to fabricate. Initial costs also will be lowered.

Magnesium alloys with exceptionally high damping capacities will become important in the military electronics field. The first, K1A, is available in sand castings and diecastings; others will follow. High-damping alloys also have possible commercial applications, such as in reducing noise resulting from vibration in motor vehicles.

Results of Extrusion Tests On Beryllium Encouraging

—EDMUND M. VELTEN

• Because of its lightness, stiffness, and performance at elevated temperatures, beryllium is being seriously considered as an aircraft structural material. The relatively low ductility of the metal produced by present methods will somewhat restrict its utility until a more ductile type is developed.

In a number of aircraft applications, the material would be quite acceptable if it could be supplied in such standard metalworking forms as sheets, extrusions, and forgings. There is every reason to push the development of additional fabrication techniques independently of efforts to improve ductility.

The Air Force is sponsoring several research and development programs for the purpose of improving the properties of beryllium metal and evolving fabrication procedures. In addition to the beryllium producers, several airframe manufacturers, fabrication specialists, and research organizations are active in these programs.

Tubing with Ultrathin Wall Will Be Made in Many Alloys

—J. S. RODGERS

• Industry is quickly learning to use exotic metals such as zirconium, columbium, and molybdenum. Their nuclear properties and high temperature and corrosion resistance have made them essential to new developments in nuclear energy, missiles, and chemical and petrochemical processes. Work in the metallurgy of these materials has progressed and will continue to progress rapidly.

In the case of zirconium and the zircaloys, major fabrication difficulties have been solved. Tubing can be extruded to customers' orders in a wide range of diameters and wall thicknesses. Production rose steadily in 1958 and further increases in 1959 will lower prices. Seamless zircaloy tubing will then be more competitive with stainless steel and other corrosion-resistant materials.

Columbium has been successfully extruded and fabricated into tubes as thin as 0.500 × 0.030 in. in cross section. Next year, columbium seamless tubing will start winning a foothold for itself in industry.

It is also expected that substantial progress will be made in 1959 in fabrication methods for ductile vanadium and tantalum tubing.

Knowledge Is Key to Economy In High Temperature Steels

—RALPH L. WILSON

• As the use of steels for high temperature service grows in volume, greater discrimination will be given to the economical use of alloying elements.

With the accumulation of more data on high temperature properties, three fundamental mechanisms for increasing high temperature strength in steels are recognized (apart from simple solid solution effects): 1. Alloying to increase the temper resistance of martensite. 2. Alloying to produce secondary hardening. 3. Alloying to permit precipitation hardening.

Each of those mechanisms has a limiting temperature beyond which stable strength properties cannot be maintained for long periods. These temperatures are of the order of 600, 1100, and 1400° F for the respective classes of steels.

Aluminum Outlook Is Good, Packaging Shows Sharp Growth

—JOHN R. WILLARD

• Intensive and imaginative research and development, coupled with an integrated sales effort, leads us to believe that aluminum mill shipments in 1959 will run about 2 million tons, up 15 to 20 per cent from the 1958 level.

Building and construction will continue as one of the largest consuming markets, taking 485,000 tons. Its use in new residential construction spurted when National Homes Corp., Lafayette, Ind., announced three moderately priced homes utilizing from 1400 to 2000 lb per model.

The transportation industry should consume at least 370,000 tons. Aircraft and missiles should account for another 120,000 tons. Perhaps the most dramatic indication of aluminum's steadily increas-

Name your bearing needs...we'll meet 'em pronto from 30 types, 10,247 sizes

TIME and time again, machinery makers come to the Timken Company for help with some special bearing application problem. One they think hasn't been solved before. And time after time, from our 30 types and 10,247 sizes of Timken® tapered roller bearings, we've come up with the bearing design to do the job and at minimum cost.

It's no accident that we can help out so often. In sixty years of helping machinery builders with bearing problems, we've engineered and produced the world's largest selection of tapered roller bearings. And we've constantly improved our designs. The answers to thousands of bearing application problems are already in our files. Ready and available to help you.

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Why not call on our engineers for help whenever you have a bearing application problem or requirement? Timken is your No. 1 bearing value. Wherever wheels and shafts turn, Timken bearings eliminate friction, cutting wear and maintenance to a minimum. Specify bearings trade-marked "Timken" for the machines you buy or build. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ont. Cable: "TIMROSCO".

This symbol on a product means its bearings are the best.

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TAPERED ROLLER BEARINGS ROLL THE LOAD

Materials and Metallurgy

J. H. JACKSON
Manager, Dept. of Metallurgy
Battelle Memorial Institute
Columbus, Ohio

KEMPTON H. ROLL
Executive Secretary, Metal Powder
Industries Federation, New York

MARTIN N. ORNITZ
Vice President—General Manager
National Alloy Div., Blaw-Knox Co.
Pittsburgh

ing role in production is the planned use of cast aluminum in automobile engines.

A continuing large market is consumer durable goods manufacturing. This segment is expected to take about 250,000 tons.

The electrical and communications industry is expected to consume about 200,000 tons. New developments in coil winding make it possible for the electric motor builders to use aluminum sheets and foil in place of copper wire and realize savings of up to 50 per cent in material costs as well as reduced winding costs.

Another 220,000 tons of aluminum is expected to go for the manufacture of nonelectrical machinery and equipment.

Containers and packaging, one of the sharpest growth areas, will consume more than 110,000 tons, principally in sheet and foil form. All other uses in 1959, including other defense applications, metal for steel deoxidizing, for alloying and miscellaneous other uses could amount to as much as 300,000 tons.

Metalworking Must Learn How To Use More Brittle Metals

—J. H. JACKSON

• Renewed interest is evident in the use of titanium in aircraft, missiles, and other military systems. The state of the art of producing and fabricating titanium is well along and it is just another metal in many shops today.

Molybdenum is an outstanding candidate among the refractory metals for use in military systems. Production of the metal increased last year. The most serious problem is its oxidation at high temperatures. Another major problem of molybdenum technology is the production of consistent quality in mill products.

Beryllium, as a potential structural metal in airborne equipment, has enjoyed a flurry of experimental interest. Its high modulus of elasticity in proportion to its weight, and its high melting point thermal conductivity and specific heat combined with its light weight make it potentially an excellent heat sink for airborne vehicles. Beryllium has been of interest in nuclear applications because of its low thermal neutron capture cross section. Development of more ductile material and improved welds are needed.

Columbium is a potential substitute for molybdenum in many applications. It has lower density and is somewhat easier to fabricate, has a lower melting point, but has better oxidation resistance. Research to develop columbium alloys with good high temperature properties and good oxidation resistance is underway.

Tungsten has an interesting combination of properties that make it one of the few potential materials for solving some of the problems where high temperature and high-heat flux are encountered in advanced weapons systems.

Steels of high strength levels are rapidly coming into use. We have seen the application as an aircraft structural material of a steel originally developed for hot forging dies. Steels of 300,000 psi ultimate tensile strength are coming in now and the ultimate development of steels of 400,000 psi is to be expected. There will be a general trend toward materials tailored for a specific end use.

We are going to have to learn to use more brittle materials through suitable design and handling techniques. Many of the newer materials will be difficult to machine and to form. They will be expensive.

Larger Presses, New Methods Coming in Powder Metallurgy

—KEMPTON H. ROLL

• Direct production of strip from metal powder will start in 1959. Large tonnage pilot operations were carried on successfully last year. Development work on economic production of copper tubing from powder is entering an advanced stage.

Size limits for powder metallurgy parts are disappearing. Reason: Larger presses and new techniques. This year may see 1958's record 30-in. diameter rings (for jets) and 235-lb bearings topped again.

One "exotic" method of forming metal powders may be used commercially this year in making these large parts. "Implosive compacting" subjects a large cylinder of metal powder to a directed explosive detonation. The result is a metal ingot having close to 100 per cent density. The high purity and precise control of composition of such ingots and parts are virtually impossible to achieve by conventional high temperature metallurgical methods.

Look for development of new mass production uses of powder metallurgy, probably hinged on special properties of the fabricated parts. One such possibility may be automotive brake linings where the unique controlled friction possibilities of powder metallurgy parts can come into play.

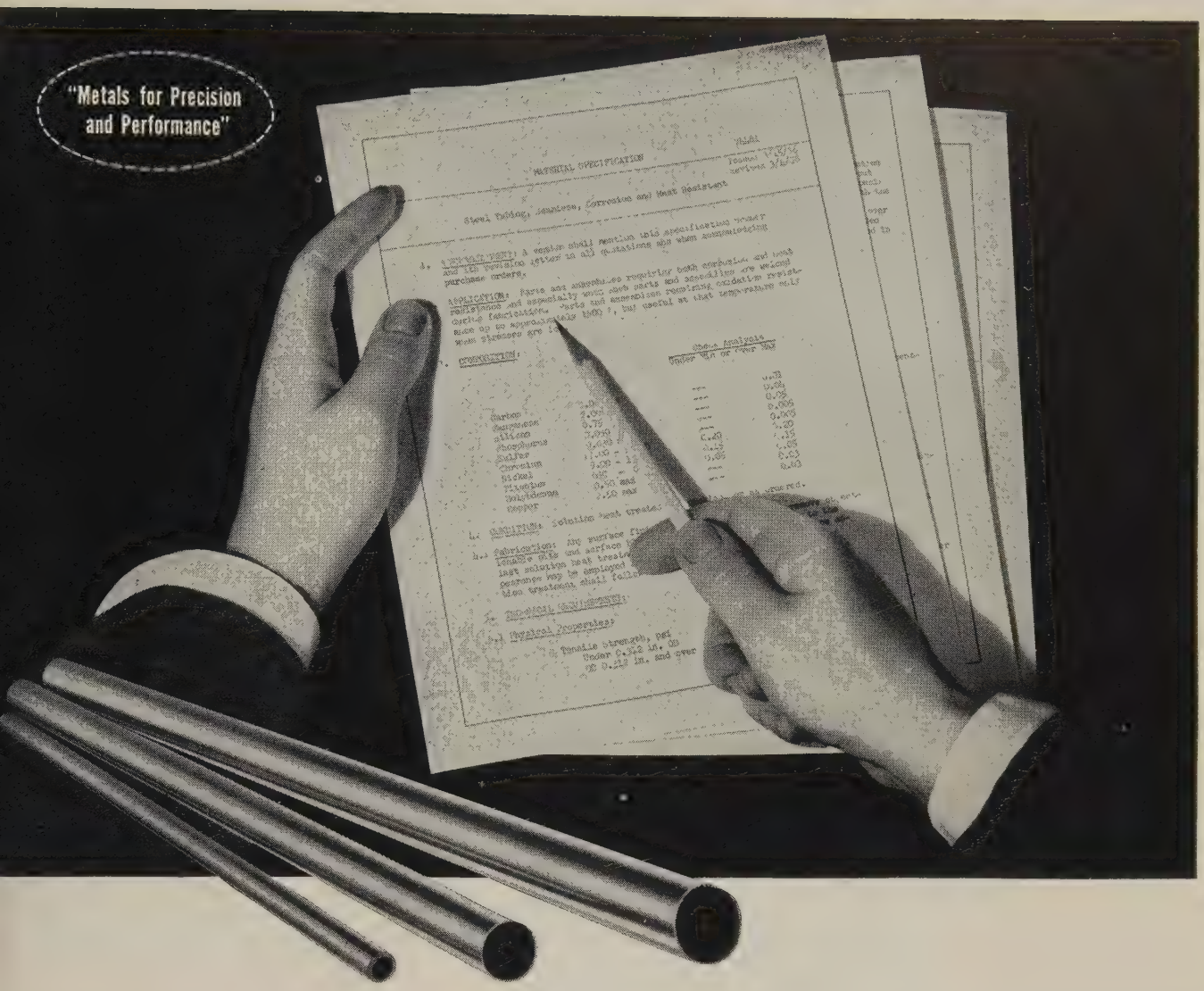
Watch, too, for basically new powders as starting materials. Already the H-iron and R-N processes are changing the complexion of powder materials. Higher alloy powders are also coming into use generally. New methods of protecting conventional iron powder parts are under development and show promise of vitally widening their use pattern.

New Heat Treat Techniques Demand Better Furnace Alloys

—MARTIN N. ORNITZ

• Recent developments in forming and new techniques in heat treatment are pushing the temperature ranges for heat treating above 2000° F.

Marked changes in the technology of furnace design and heat treating processes bring demands for alloys capable of performing for long periods at higher temperatures with the strength necessary to support the loads. They must have improved surface stability to withstand the chemical reaction of prepared atmospheres, corrosive conditions occurring from reactions of heat treating, and the



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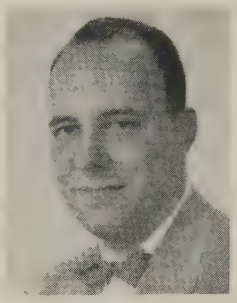
Materials and Metallurgy



C. T. EVANS JR.
Vice President, Technology & Development, Universal-Cyclops Steel Corp., Bridgeville, Pa.

ability to transfer heat on a rapid scale.

The continued evolution and development of continuous annealing furnaces such as employed for tin plate, galvanizing, and silicon grades is another major trend requiring increased technology in the use and manufacture of high alloy castings.

Typical of the type of processes presently under development is the improvement in carburizing techniques by increasing temperatures from 1700 to 1900° F, for carburizing steel. Here, in addition to stress and load carrying capacity, is the need for resistance to carburization of the alloy.

Improvements and changes are occurring in the heat treating of stainless and continuous brazing applications, as well as that of sintering processes and techniques. All of these furnaces are going to temperatures in the range of 2000° F, and higher; and all will be used with controlled atmospheres or vacuum.

Emphasis in Vacuum Melting Is on High Temperature Uses

—C. T. EVANS JR.

• Progress in vacuum melting processes continues at a rapid pace. An increasing variety of alloys are being processed, with emphasis continuing on materials for high temperature applications.

The rapid progress of the missile industry has increased concentration on lower alloy grades which may not have to withstand more than 400 or 500° F in service. They would be useful for the first two stages of an ICBM. Ultrahigh temperature material is needed only in the third stage to take care of the reentry heating problem.

The most refractory materials available, such as molybdenum and tungsten, must be considered for the third stage of

Materials and Metallurgy

T. F. OLT
Vice President, Armco Steel Corp.
Middletown, Ohio

CBM's and the requirement is creating ew problems of supply in a wide variety f mill products. In an effort to solve ome of those problems, the Navy and Universal-Cyclops are building In-Fab, which will permit the forging and rolling f refractory and reactive metals at temeratures as high as 3500° F in a proective atmosphere of argon.

It is expected that the facility will get ts first tryout late this year. If it works, will go a long way toward solving the host pressing problems facing the reractory metal industry.

Precipitation Hardening Steel Used in New Designs

—T. F. OLT

In developing the steel-titanium airlane for 2000 to 2700 mph flight, changes n materials and basic design of airframe tructures have been mandatory. To utilze the high strengths of the special steels, ightweight honeycomb panels have been eveloped.

During initial production of brazed teel honeycomb panels, costs were high. n 1958, with improvements in process nd with more experience, several comanies reduced costs sharply. Still newer echniques for faster production rates re in the development stage. It is likely hat some of these new processes will ome into production this year.

In the jet engine field, more use is eing made of precipitation-hardening ainless steel forgings, castings, and ormed sheets joined by welding or brazng. Considerations here, other than rength, include relative ease of mahining the steels in a partially hardened ondition after assembly. Distortion is inimized due to the low temperature of he final hardening operation.

In the missile field, 17-7 PH stainless

Materials and Metallurgy

JOHN C. HAMAKER JR.
Manager, Research Dept.
Vanadium-Alloys Steel Co.
Latrobe, Pa.

steel has been useful for light, high pressure tanks for liquid propellents. With the emphasis on solid propellents, the requirement for corrosion resistant materials has been reduced and the lower alloyed, high strength steels are somewhat difficult to fabricate and heat treat with uniform results. Ease of fabrication and heat treatment of the precipitation hardening stainless steels may favor their use for solid propellent casings.

High Strength Steels May Often Replace Exotic Alloys

—JOHN C. HAMAKER JR.

• High strength and heat resistant materials are in an era of rapid development that foretells significant changes in the usage of various alloy types and analyses within the next few years.

Defense requirements for thermal barrier aircraft and missiles have accelerated material developments to provide new design potentials for engineers in many fields. Further shifts in material usage are arising from cost conscious re-examination of designs with an eye to replacing exotic materials and alloys with more conventional steels where they may be capable of furnishing equivalent service.

To take advantage of the ultrahigh strength properties available in the new materials, design and production engineers must become increasingly aware of the importance of eliminating stress raisers, good fabrication techniques, and careful heat treatment. With the lower yield strength structural materials employed in the past, localized yielding and deformation at stress raisers frequently corrected for errors in design or fabrication.

With high strength steels, those errors must be eliminated initially by improved techniques. When that has been done

ACHESON

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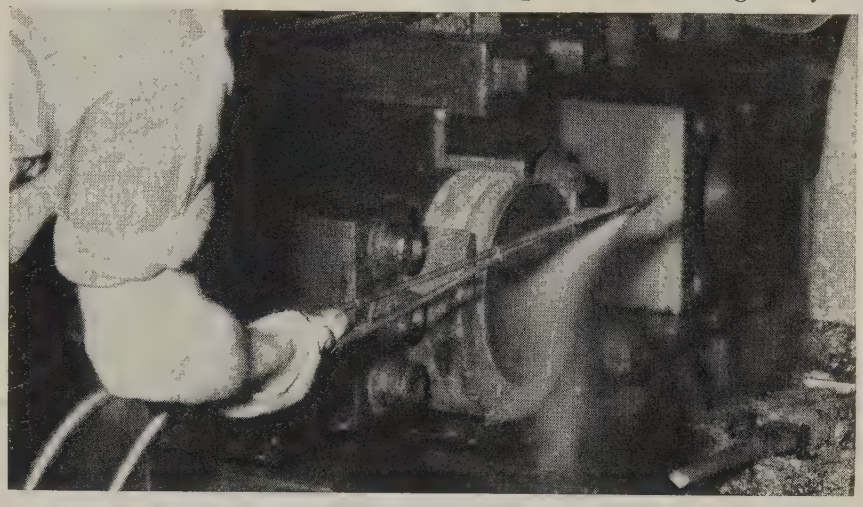
The excellent lubricating properties of Acheson Colloidal Graphite, under conditions of extreme heat and pressure have been confirmed by leading extruders of aluminum, steel, copper, brass, lead and other metals. Water-base dispersions of colloidal graphite used in the following application histories have provided savings in material handling, reduced maintenance time and expense, prevented seizure, extended die life, and produced extrusions of more uniformly high quality. Any one of these benefits should make profitable reading for you.



For faster, more uniform application with less material consumption, Aluminum Extrusions, Inc. finds 'Aquadag' their best die lubricant.

A little 'Aquadag' goes a long way for Aluminum Extrusions, Inc., Charlotte, Michigan. This company, one of the leading independent extruders in the country, has found that by applying 'Aquadag' on die surfaces they have effected a 30% savings in their material handling. Formerly, they had used an oil-graphite mixture which required a dilution ratio of 16 lbs. of graphite to a 55 gallon drum of oil. It was too slowly applied by swab and too coarse to apply by spray with any degree of efficiency.

With 'Aquadag', Aluminum Extrusions has a lubricant that is finer in particle size, permits wider coverage, and provides greater "sprayability". These minute particles pass freely through the spray nozzle, eliminating the costly downtime formerly involved in cleaning clogged equipment. The tough, dry film 'Aquadag' forms upon the evaporation of its water carrier, doesn't smoke or react when applied to hot dies and metals. This improves working conditions as well as extends die life. Important also to both die surfaces as well as the finished extrusion, is the fact that this durable, low-friction film allows easier, more uniform metal flow.

Considered in relation to the over 12 million pounds of aluminum extruded yearly at this plant . . . 85% of it in fabricated form . . . *'Aquadag' has brought important production efficiencies and material economy* to Aluminum Extrusions, Inc. In many, similar instances where product quality and basic economy are demanded, Acheson colloidal dispersions have gained ready acceptance.

Exclusive Acheson processing techniques guarantee a consistently uniform top-quality product. If your problem is more effective lubrication under normally adverse conditions of extreme temperature, pressures, or abrasion, call in your Acheson Service Engineer.

Extended die life and extrusions with more perfect surface finish, are attributed to the use of 'Aquadag'.

Dies last three times longer with 'Aquadag', according to another prominent midwest extruder. Metal pickup on the extruding dies has been completely eliminated by the use of this Acheson dispersion, extending the effective use of the dies from 1000 to 3000 strokes. The evaporation of its water-base leaves a dry, adherent "graphoid" film on all lubricated surfaces, inhibiting the build-up of abrasive precipitates. At the same time, the unbroken, microscopically-thin film that 'Aquadag' provides, facilitates metal flow and reduces scoring to a negligible minimum. Application of the lubricant is by spraying a dilution of 1 part 'Aquadag' to 20 parts water, on the die surface before each "push" of the extrusion press.

A 'dag' graphite coating is also applied to the follow blocks on this company's 1400 ton horizontal extrusion presses. For purposes of even greater economy, 'Prodag' — semi-colloidal graphite in water — is used in this application. This effective parting agent prevents the flash, back-extruded from the billet skin, from locking the butt to the follow block. An Acheson dispersion is very possibly the answer to your lubricating troubles. For additional information, write for your free copy of Bulletin 426. Address Dept. S-1.

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Materials and Metallurgy

RICHARD E. PARET
Committee of Stainless Steel Producers, American Iron & Steel Institute, New York

in the structures produced so far, tremendous gains in weight, space, and material saving have been realized even in complex designs.

Stainless Is Important To Missile Technology

—RICHARD E. PARET

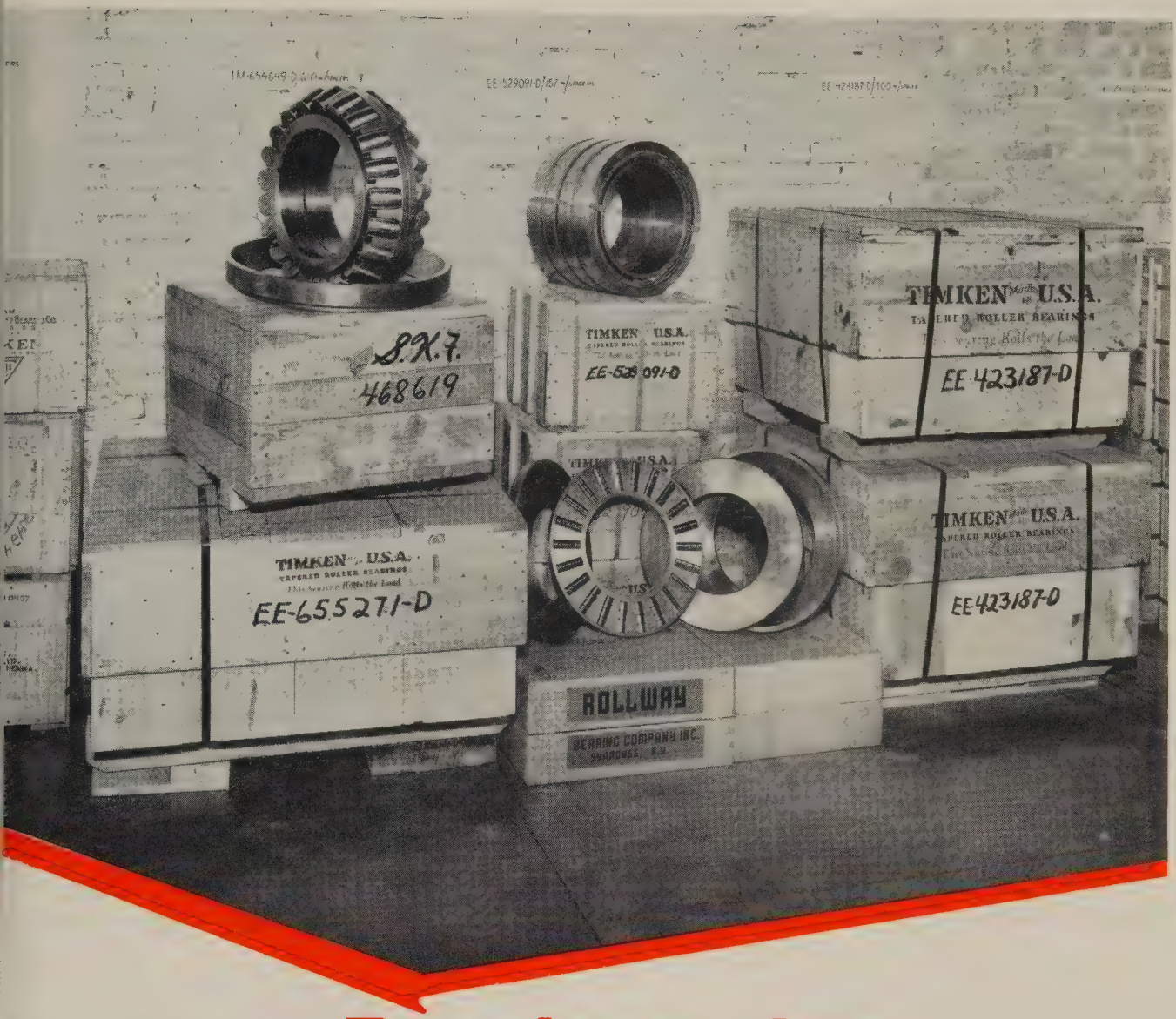
• New developments in stainless fabrication are being spurred by requirements for closer tolerance and higher strength-weight ratio components for aircraft and missiles. Breakthroughs have been made in the art of explosion-drawing steel parts in extreme depth.

Conventionally formed extrusions are generally of closer tolerance due to improvements in die and lubrication technology. More complex shapes are being produced, and multiorifice dies are increasing output for some extruders. The development of flat container extrusion of stainless holds promise for the production of wide, integrally stiffened skins and other complex shapes.

Flexible die forming methods are being further developed for stainless component fabrication. No-draft forgings of complex configurations are being made on the large Air Force presses for the newest generation of military and aircraft vehicles. A wider use of spin forming is also evident.

Welding of stainless is further being stimulated by increasingly stringent requirements in aircraft, missiles, and atomic energy. Almost all the Atlas airframe is thin-walled stainless steel, finely welded section over section.

The largest market for stainless continues to be the automotive industry. Functional brightwork and ornamental wheel covers are dominantly stainless. The alloy is a strong contender for front and rear bumpers.



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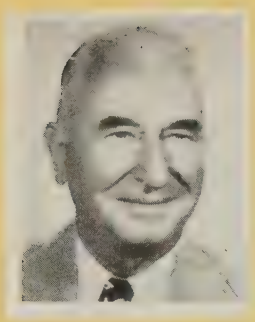
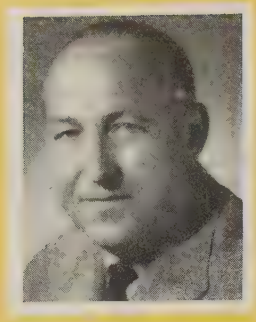
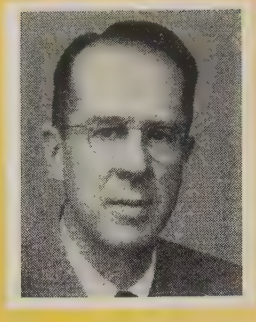


P. C. OSTERMAN
President, American Gas Furnace Co., Elizabeth, N. J.



CARY H. STEVENSON
Vice President, Lindberg Engineering Co., Chicago



L. B. ROSSEAU
President, Ajax Electric Co. Philadelphia

A. F. HOLDEN
President, A. F. Holden Co. Detroit

1959 FORUM ON TECHNICAL PROGRESS

Heat Treating

Production Cutbacks Promote Trend to Smaller Furnaces

—P. C. OSTERMAN

• In the heat treatment industry, greater care will be exercised in the selection of equipment in the years ahead as effects of the recent slowdown are analyzed in the light of over-all costs.

Those concerns who were equipped with furnace equipment most versatile and more easily adapted to various processes suffered the least from the shrinking of the economy. Extremely large and highly specialized equipment must have continued production to pay for its use and upkeep.

With continued production, large single units are the least expensive to run and may represent the least initial investment, but when reduced production is necessary they become uneconomical. Therefore, the trend will be to spread production, when feasible, over smaller units.

With the increasing accent on missiles in our defense program, the large number of government cost-plus contracts for other items, many of which require heat treatment, will also diminish, making it mandatory to select equipment which will assure a continuing profit in a competitive market.

Increased demand for stainless steel fasteners in the automotive field, as well as in many appliances, has encouraged our industry also to devise better ways of handling that product. The progressive equipment means of handling and better results will be reflected in the regular line of equipment also.

Rapid Missile Development Has Revitalized Technology

—CARY H. STEVENSON

• The great strides in missile development will bring new revitalizing materials, methods, and equipment to the rest of U. S. industry.

New ultrastrength steels, including air hardening, martensitic, and vacuum melted types, are developing tensile strengths unheard of until recently. Vacuum heat treating, atmosphere heating, and quenching of large structures, brazing of honeycomb and other fabricated designs, all have applications in many fields. New superrefractories make some of those methods possible.

The pressure of defense needs provided incentive and funds to complete development ordinarily requiring much longer.

The slackening of production particularly in the capital goods field may also be viewed as an important factor in the astonishing progress in many technical fields during 1958. And the "soaring sixties" may well belong to those who first realize the richness of those developments.

Gas Fired Salt Bath Furnace With Internal Heating Coming

—L. B. ROSSEAU

• Refinements in salt bath equipment have brought about better quality of product through closer control of temperatures, better surface protection, reduced distortion, easier maintenance and longer life of the furnace, and more complete mechanization.

The outlook is improved by two new factors.

The first is favorable evidence of the ease and economy of extending liquid carburizing procedures to the higher operating temperatures being considered by industry.

The second is the perfecting of a gas fired, salt bath furnace which has internal heating. Such equipment has been limited to the electrode type furnace for all operating temperatures above 1200° F, including those required for forging purposes at 2300° F and up.

Instantaneous Heat System Proved, Has High Potential

—A. F. HOLDEN

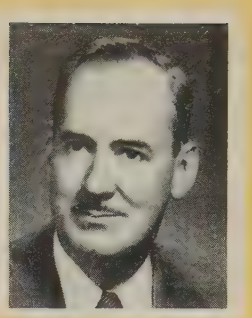
• Instantaneous heat, or the Luminous Wall system, will gain wider acceptance in 1959.

Test data for ceramic coatings on metal

JAMES R. COLEY
Secretary & Sales Manager
Ajax Electrothermic Corp.
Trenton, N. J.

K. U. JENKS
President, Metal Treating Institute
Lindberg Steel Treating Co.
Melrose Park, Ill.

R. L. HARPER
Executive Vice President
Harper Electric Furnace Corp.
Buffalo



ELTON E. STAPLES
Vice President, Hevi-Duty
Electric Co., Milwaukee

prove that this gas system of combustion is equal to electricity in temperature uniformity. The combustion does not affect the ceramic type paints for such metals, nor does it affect the luster for weatherability requirements.

The method is being used in the aluminum industry for melting. Aluminum components of auto air conditioning units are being brazed in a Luminous Wall furnace and it has been used to thaw ore and coal cars.

Proof tests on snow removal from ramps and airports to facilitate loading and unloading will be made this month.

Automation of salt bath treatment has come into use during the last two years. You can expect to see more such installations this year.

Static Device Will Fill Gap In Induction Heating Field

—JAMES R. COLEY

• The recent development of low cost, static equipment, we feel, will speed wider acceptance of induction heating by the metals industry. Such equipment will fill the gap between line frequency and the higher frequencies available with conventional motor-generators.

The new concept of frequency conversion has the simplicity and dependability of a transformer. On the larger heating jobs, the static unit will do the job of a motor-generator. It may also be used as a power source in combination with a motor-generator in dual-frequency heating applications. Used with conventional motor-generators, it can provide higher frequencies for many heating applications with no major reduction in efficiency.

It is adaptable for melting chips, borings, and turnings because it stirs or agitates the molten bath. In vacuum melting, the increased stirring effect will permit more rapid outgassing of the molten metal. Large induction vacuum furnaces in the capacity range of 5 to 10 tons will not require additional line frequency equipment to stir the molten bath.

Continued developments toward low initial cost and efficient equipment will have a tendency to break the price barrier and improve capital equipment purchases in our industry.

Space Age Hardware Requires Special Heat Treat Methods

—K. U. JENKS

• The Space Age has brought new challenges to the commercial heat treater. Although quantities of hardware to be heat treated are relatively small, the dimensional characteristics involved necessitate development of special heat treating techniques and the installation of huge new facilities.

Methods and processes hitherto employed only to a limited extent are being perfected. Temperatures will be controlled by automatic electronic instruments coupled with magnetic amplifiers and saturable core reactors. Atmospheres will be controlled by dual recording-controller units which will automatically sample the atmosphere in the furnace and signal valve adjustments to maintain desired carbon potential.

We believe such improvements will soon be in common use by the commercial heat treater on both civilian and military work.

Builder Cites the Need for Engineering Study Contracts

—R. L. HARPER

• We foresee a rapidly increasing demand for higher temperature technology and for more automation in industrial heating equipment.

The requirements of high temperature research (300 to 6000° F) will continue to force furnace builders to be one jump ahead of research people.

Science is searching for high temperature materials that will stand up in an oxidizing atmosphere. Our continuing problem will be to find materials for constructing environmental chambers which will withstand the temperatures for testing tomorrow's specimens.

Automation is becoming more vital as manufacturers seek relief from the ever-mounting squeeze between labor costs and resistance to price increases. We are not referring merely to automatic heating equipment, but to automated production lines into which the heating equipment is fully integrated.

To meet growing demands for both high temperature and automation, industrial heating equipment manufacturers like ourselves will find that we must become specialists in certain areas where we are qualified to offer top caliber engineering service.

In an increasing number of cases, this specialization should lead to engineering study contracts instead of competitive bids on advance design equipment. We cannot afford to put advance engineering into highly specialized furnace bids on a speculative basis. It is becoming more and more apparent that buyers get the best designs with engineering study contracts.

Trend to Automatic Units For Heat Treating Continues

—ELTON E. STAPLES

• In the immediate future, several developments can be expected, most of them continuations of a long term trend. Search is continuing for higher strength, high temperature alloys and refractory metals. These require higher temperature furnace equipment for production, fabrication, and testing techniques. Large continuous furnaces are being built to handle 1000 lb or greater loads at 3500° F.

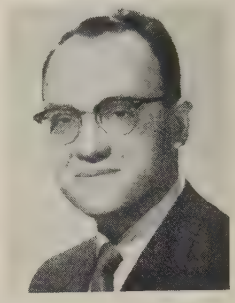
There is a continuing shift to auto-

Heat Treating

DONALD E. MOAT
Vice President—Marketing
Leeds & Northrup Co.
Philadelphia

H. M. HEYN
President, Surface Combustion
Corp., Toledo, Ohio

VINCENT R. TROGLIONE
Vice President & General Manager
Sunbeam Equipment Corp.
Meadville, Pa.



IRVING DICKTER
Chief Metallurgist, Meta-Dynamics
Div., Cincinnati Milling Machine Co.
Cincinnati

matic heat treating units to harden, quench, wash, and temper without need for operator attention. Speeding the work through the plant by automation is also applied to high temperature carburizing equipment which permits heavier case carburizing at 1800 to 1900° F followed by slow cool, or by cool and quench.

In the automotive field, use of aluminum alloys is being accelerated. These alloys require melting and heat treating equipment of large capacities. There is also a continuing increase in the use of aluminum extrusions for transportation equipment, architectural applications, and furniture. The continuous casting of aluminum billets or extrusion slugs is common and increasing. Large capacity aluminum melting, homogenizing, and billet heating equipment are being used in this field.

A greater quantity of aluminum will go to the container field for food products, beverages, and spray bombs. The automatic casting of aluminum slugs for impact extrusion of these containers represents a great saving over production of slugs by other means and makes the wide use of these containers economically feasible.

More Use of Static Devices Seen in Heat Treat Control

—DONALD E. MOAT

• With the management of metalworking plants striving to find new ways of reducing processing costs, of developing new methods, new metals, and new alloys, the role of instrumentation is becoming increasingly significant.

Already, many heat treat processes are operating at higher temperatures. Precise control of those temperatures becomes critical, both to product and equipment. To perform its task, instrumentation must be thoroughly reliable, accurate, and flexible.

Current trends in metalworking instrumentation include:

1. Greater use of control devices and components having no moving parts, such as saturable core reactors and magnetic amplifiers, and transistors.

2. Standardizing on primary elements to simplify the stocking of replacement parts and improve servicing efficiency.

3. The use of more accurate, more compact controllers and recorders, often with auxiliary devices for centralizing data about an entire heat treating process, or group of processes.

4. A wider use of atmosphere control to protect the work, eliminate rejects and spoilage, and handle difficult heat treat jobs on a reproducible basis.

More Heat Treaters Buying Completely Assembled Units

—VINCENT R. TROGLIONE

• In this era of increasingly greater competition, every progressive metalworking company is on the lookout for new ways to cut costs. This has become apparent to us in two ways: The trend toward providing our customers with completely assembled and tested furnace equipment at the time of delivery to the installation site, and a keen interest in new product developments.

To better serve our customers, we recently purchased the production facilities of the Industrial Heating Div. of Westinghouse Electric Corp. and have moved our operations from Chicago to Meadville, Pa.

A major share of furnace equipment we supply to industries today has been tested and assembled by the time it reaches the customer's plant.

The greater interest in new furnace developments has been made evident to us by the increase in inquiries on products displayed at trade shows and in advertisements. This, we believe, is merely a reflection of management's belief that to stay on top a company must be acutely aware of every possibility for applying new processing methods.

Heat Treat Research Needed To Meet New Requirements

—H. M. HEYN

• Government and industry will have to combine their efforts to guarantee stability so that the metal industry can be kept healthy and flexible in the military and economic cold war.

We must produce more and better things from the ingot to the finished product. To us, this means that we will have to meet all requirements of the metal industry and keep in step with all metallurgical and process improvements.

Research and development will be important, leading to more time saving devices for completely automated lines as well as for individual mechanized batch type units. The same applies to improved quality control methods, higher purity atmospheres, and furnaces to meet higher temperature requirements.

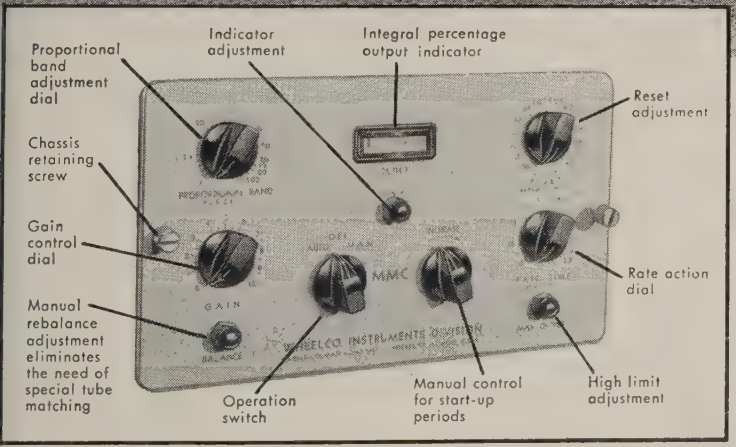
The increasing demand for light metals and their application has already resulted in the design of new and improved furnace lines for aluminum, copper, and brass production.

Much obsolete heating and heat treat equipment in use must be replaced. With labor cost constantly increasing, management is expected to take a close look at appropriations early this year.

Rotary Burners May Solve Problems in Flame Heating

—IRVING DICKTER

• Those of us who are interested in flame heating are extremely conscious of oxygen costs, since each decrease in oxygen price increases the number of applications which can be economically



The 3-function controller for automatic rate, reset and proportioning action on a millivoltmeter-type controller is a Wheelco exclusive. It provides outstanding process control accuracy at minimum cost.

Harsh thermal shocks must be avoided in this induction heating setup for growth of germanium semi-conductor crystals. Growth is in Vycor tube with heating coil on outside and carbon ring holding thermo-couple inside.

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Heat Treating

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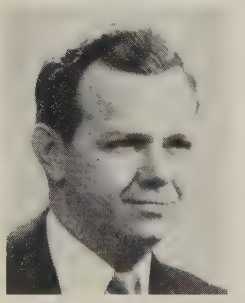
General Manager, Industrial Heating Dept., General Electric Co.
Shelbyville, Ind.

ROBERT E. FLEMING
Executive Vice President
Industrial Heating Equipment Assn.
Washington



JOHN A. LOGAN
President, Magnethermic Corp.
Youngstown

processed by flame heating methods.

Oxygen producing installations in the plants of large users are increasing. It is our hope that expanded activity will eventually result in lower oxygen costs for the small and medium quantity users.

Because of the emphasis placed on missiles and rockets, we note the ever increasing activities in flame research, rocket burners, and plasmajet burners.

The steady progress reported in those fields causes one to wonder how soon it will be before those enormous heat sources can be controlled for flame hardening applications.

Interest in automatic equipment for flame hardening continues high. Improvements in some of the auxiliary equipment is of benefit to current applications and opens the way for new flame heating uses.

The development and availability of a rotary burner is an answer to a long felt need in flame heating burners. Some thin walled parts when heated internally may collapse when held externally while being rotated. A change to an internal rotating burner would prevent that from happening. Odd shaped parts which are difficult to position are much more easily handled by using a rotating burner.

Some external work, like localized heating on the end of a shaft, might be better accomplished by rotating a U-shaped burner rather than the whole shaft. Rotating mechanisms, such as this, find a number of uses where localized areas are to be heated on a number of different parts. Such flame burners would be a lot simpler to make and would be applicable to a greater number of parts than if the part were rotated.

Furnace Improvements Promote New Heat Treating Techniques

—ROBERT B. HANNA

• The demand for higher temperatures, especially from the aircraft and missile industry, continues. We are designing equipment to operate at 4000° F in vacuum.

A major development in 1958 was the muffleless electric furnace for bright annealing or brazing of stainless steel. A new type refractory lining does not contaminate the hydrogen, so the muffle is not needed. This eliminates an expensive maintenance problem and greatly decreases downtime, and it permits building such furnaces for higher temperatures.

Continuous annealing of metal strip has been improved with high speed cooling—impinging jets of air or protective atmosphere. The unitized coolers are designed for easy adaptation to various types of continuous strip heat treating equipment.

Furnaces, utilizing metallic retorts, have been built to permit treating materials with air or gas pressures ranging from 1 micron to 15 psi and temperatures up to 2150° F. Such equipment provides a new tool for brazing, sintering, degassing, and other heat treatments which were not possible previously.

The cold wall, or radiation shield vacuum furnace, has been made more adaptable by incorporating means of introducing and circulating hydrogen, argon, or helium to accelerate cooling of the charge.

Progress has also been made in the continuous annealing and oxide blueing of magnetic steel laminations for motors and transformers. Fully automatic roller hearth furnaces have been developed to carry out the entire operation.

Unusually large furnaces are being developed for the high temperature brazing of stainless steel honeycomb structures for high speed aircraft. They are arranged for rapid cooling of the charge after heating.

Heating Equipment Exports Will Exceed High 1958 Level

—ROBERT E. FLEMING

• Manufacturers affiliated with the Industrial Heating Equipment Association are virtually unanimous in their expectations that 1959 will be the initial year in a general market expansion for industrial heating equipment. A recent survey of top management opinion in the industry reveals that during 1959 new business will increase about 20 per cent over that of last year.

It is expected that exports of furnaces, ovens, induction and combustion equipment will exceed the high foreign demand attained in 1958 when it rose 18.5 per cent above the preceding year.

The great efforts of our industry in research and development are responsible for the expected expansion in business activity. Remarkable progress has been made in the design and operation of vacuum heating equipment, high purity atmosphere generators, salt bath processes, low and high frequency induction heaters, precision quenching units, and combustion devices.

Great strides are anticipated in the field of automation for continuous processing to insure low cost, high quality production. Moreover, the industrial heating equipment requirements of the Space Age will undoubtedly spur a variety of related developments.

The major departure in 1959, as we see it, will be a significantly greater reliance by industry in general on knowhow of industrial heating equipment manufacturers. More firms will obtain the benefits of the technical ability of the heating equipment manufacturers by inviting an investigative approach to insure optimum results with greater safety and economy.

Induction Heating Expanding In Forging, Extrusion Areas

—JOHN A. LOGAN

• It now appears that business conditions of the last 12 months may have been a boon to the induction heating industry. With greatly relieved pressures on immediate production, management and engineering groups have been able to more thoroughly investigate methods for cost reduction and product improvement.

The next 12 months should see some solid growth in the industry. Applications

PEOPLE & U.S. ENGINEERING & RESEARCH

Key Dwight-Lloyd® personnel, at left, photographed in the Lab.
Counterclockwise from left:
ROBERT C. McDOWELL, *President*, McDowell Company
PATRICK V. GALLAGHER, *Vice President*, McDowell Company
THOMAS E. BAN, *Director of Research*, McDowell Company
CHARLES D. THOMPSON, *Assistant to the Director of Research*
CHARLES A. CZAKO, *Research Metallurgist*
HAROLD E. ROWEN, *General Manager*, Dwight-Lloyd Division
ALLEN R. ROWEN, *Chief Project Engineer*, Dwight-Lloyd Division

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SERVING a world-wide clientele in a multitude of ferrous and non-ferrous applications, Dwight-Lloyd continuous sintering is the bonanza of today's minerals processing. Our thoroughly American engineering approach delivers custom-tailored pyrometallurgical plants distinguished by the McDowell-developed Flying Saucer®, a superior mixing disc, and our ABCs® Belt Scale.

Conclusive pilot plant work at our famous Dwight-Lloyd Research Laboratories, also founded by the inventors of the continuous sintering process, adds reputation and confidence to Dwight-Lloyd — *the granddaddy of them all and still the best.*

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Heat Treating

W. A. DARRAH
Vice President, Continental Div., Lindberg Industrial Corp. Chicago

now proving in one or two installations will be fully accepted and well underway toward general use.

In forging, studies have proved that equipment and fuel costs can be a small portion of total operating costs. The trend is toward more economical and highly productive press forging, and automatic tong feed machines. Here induction heating will provide needed scalefree, rapidly heated billets, at regularly timed intervals. Many large billet, high tonnage operations in steel extruding, forging, rolling, and drawing will go to induction heating, with several installations now operating and proving practicability and definite advantages.

In the next few years, we will see more vacuum and controlled atmosphere applications, increasing use of low cost 60 cycle induction for heat treating, and the development of equipment to economically heat treat large low production items.

Improvements Noted in Surface Protection, Gas Carburizing

—W. A. DARRAH

• New and precise dew point controls and higher operating temperatures have greatly extended the usefulness of gas carburizing. It is now possible to obtain uniform and accurate control of the carbon content for any required depth. Further, by raising the carburizing temperature a hundred or more degrees, the time required in the carburizing zone can be reduced by half.

The development of rockets and missiles has introduced a series of new metallurgical and furnace problems.

One difficult problem is the accurate heat treatment of missile bodies which in some cases reach a diameter of 6 ft with a length of 30 ft. Close control of

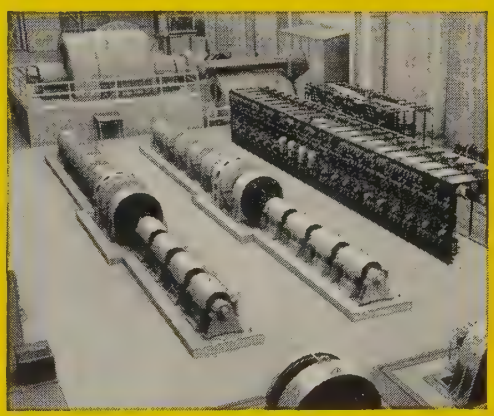
(*Please turn to Page* 274)

in Step with STEEL

The blooming mill

Maximum electrical efficiency is assured in blooming mill operations where Allis-Chalmers equipment is used. From switchgear to drive motors, Allis-Chalmers offers a tailored system — engineered by mill experts and designed to keep high quality blooms rolling fast and accurately.

From mine to final processing—Allis-Chalmers equipment is in step with the increasing tempo of expanding steel production. Contact the nearest A-C office in your district, or write Allis-Chalmers, Milwaukee 1, Wisconsin.



Blooming mill motor room view shows components of the Allis-Chalmers electrical package. Switchgear, control, constant and variable voltage motor-generator sets, *Regulex* motor-generator sets, liquid rheostat, and twin drive motors are designed to work together for peak mill output.

CHALMERS

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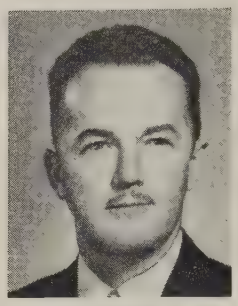
Heat Treating



H. B. OSBORN JR.
District Manager, Tocco Div.
Ohio Crankshaft Co., Cleveland

the physical properties of the metal is essential, as well as a surface free of scale and without change of carbon content.

The mechanical problems involved in handling an awkward cylinder of these dimensions, at high temperatures, and in controlled atmospheres, are substantial, but the additional requirement of an oil quench adds appreciably to the difficulty.

The commercial introduction of new metals and alloys, as well as the increasingly rigid specifications for surface conditions, have resulted in two heat treating approaches. One is the use of a vacuum. The other depends on a purified inert atmosphere—nitrogen.

Induction Heated Parts Grow In Size and Quantity

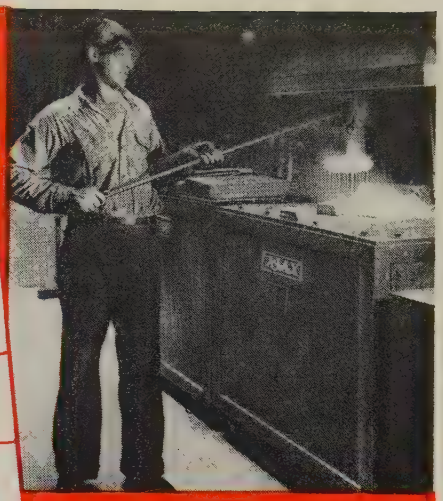
—H. B. OSBORN JR.

• The "big" push is on the induction heating field—"big" in size and "big" in numbers. Today, more than ever, we are aware that size is no obstacle and that every item going into an assembly is examined to see if induction heating cannot be used to process it at some point in its growth from a slug of metal to a finished part.

Larger production furnaces for melting tons of metal at a time, large induction coils measuring 20 to 30 ft in diameter for such things as missile components and radomes, and coils for the direct application of 60 cycles to steel billets (heating them for forging) illustrate bigness in size.

The heavy forging industry is taking a serious look at the latter application. Heavy billets and large ingots can be and will be economically heated by induction. At least one completely automated unit is planned for this year. It

Bear in mind—it takes SKILL and EXPERIENCE to Heat Treat Metals . . . Your Commercial Heat Treater provides BOTH



It takes more than equipment, no matter how modern, to perform the complex heat treating processes required today to achieve the property specifications of many metals.

Without the proper combination of operational skill and technical knowledge developed by years of experience, even the most mechanical, up to date equipment can become a menace to your product and a destroyer of your business.

Today the commercial heat treating industry has definitely established its position as the source of skilled, experienced heat treating for all types of metals. Whatever your heat treating problem, always consult your commercial heat treater FIRST.

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W. H. HOLCROFT
President, Holcroft & Co.
Detroit

will handle 1500-lb billets at the rate of one per minute, requiring 12,000 kw.

More Aluminum in Autos Boosts Heat Treat Equipment

—W. H. HOLCROFT

• A big demand for aluminum heat treat facilities in the coming year can be expected as the result of increased use of aluminum proposed by automakers.

Until recently, high volume automated heat treat lines for aluminum have been installed only in connection with wartime demand for aircraft. With the volume demands and quality controls required by the automotive industry, we can expect an increase in highly automated in-line equipment.

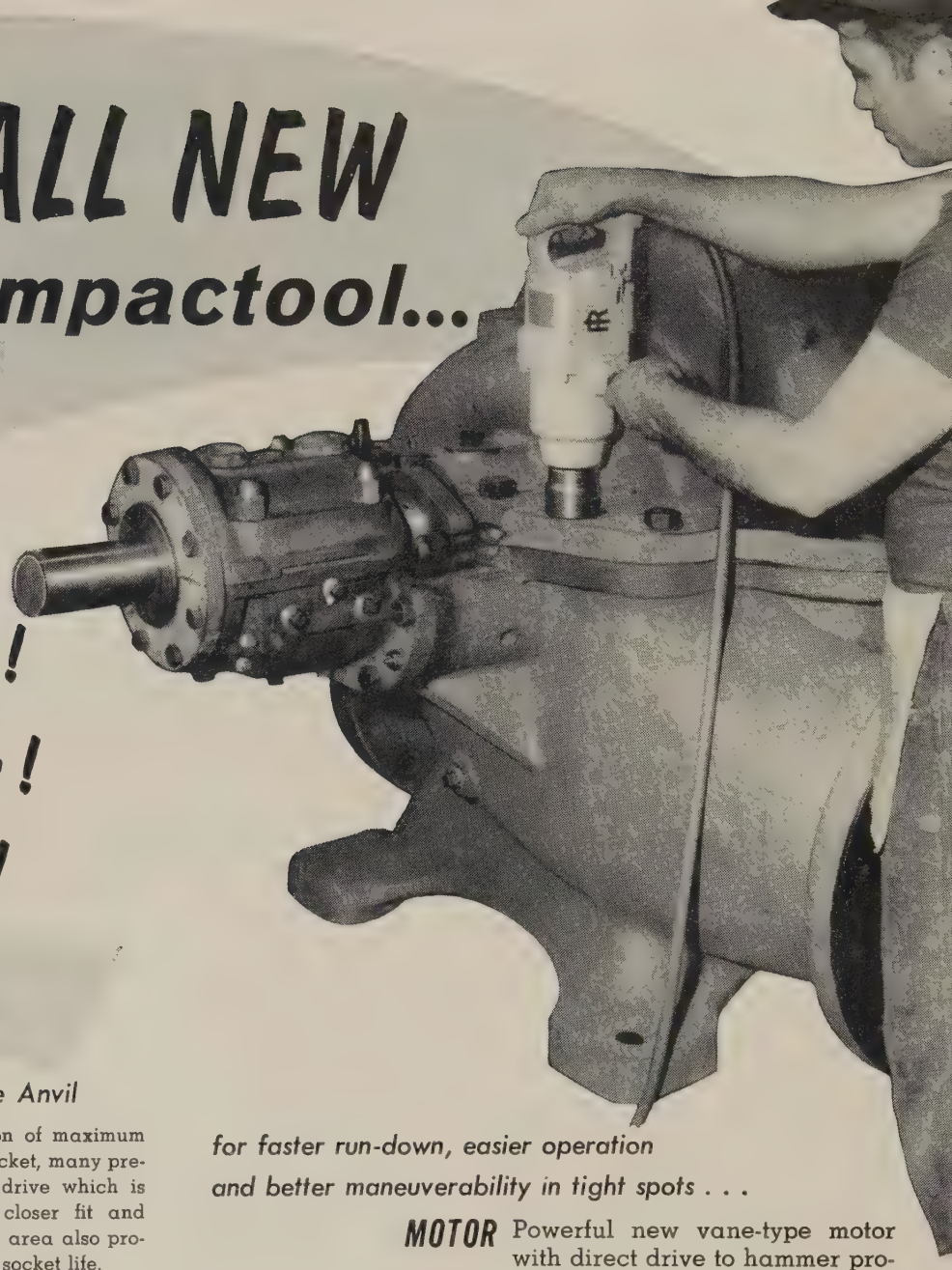
The basic heat treating problems inherent with high production are the same whether parts are ferrous or nonferrous. Handling, quality control, and over-all economy are typical.

Years ago, the automotive industry discovered that in finding the best handling methods it was necessary to consider production flow characteristics, the manual labor which could be eliminated, and the amount of automation desirable. In solving the problem of handling, it was often found that quality control and economy were improved. Over the years, the heat treat equipment in the automotive field has become the most highly automated in the world.

That same thinking will hold true in the swing to more use of aluminum. We can expect to see more and larger continuous heat treat equipment because of the many advantages involved. The design of such equipment will require not only a thorough knowledge of the heat treating requirements of aluminum but also a great deal of experience in the field of automated heat treating equipment.

introducing the ALL NEW SIZE 834 impactool...

1¼" capacity



25% more power!

3¾ inches shorter!

7 pounds lighter!

than the size 534

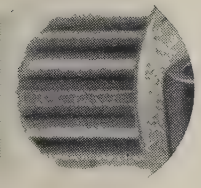
for faster run-down, easier operation and better maneuverability in tight spots . . .

MOTOR Powerful new vane-type motor with direct drive to hammer provides greater torque and five times faster run-down. Motor housing is machined from a strong, lightweight alloy.

IMPACT MECHANISM New design operates at maximum efficiency to tighten the toughest nuts and bolts. Rated capacity, 1¼" thread size. No kick or twist is transmitted to the operator.

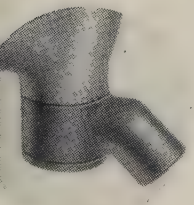
THROTTLE VALVE Graduated-action throttle valve permits quick homing of socket on nut. Rubber face provides positive seal; can be quickly and economically replaced when necessary.

optional features



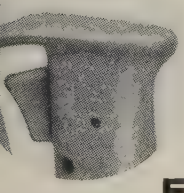
Spline Drive Anvil

For transmission of maximum power to the socket, many prefer the spline drive which is optional. The closer fit and greater driving area also provide increased socket life.



Swivel Inlet Assembly

Where extreme maneuverability is a problem, the optional swivel inlet assembly makes the hose easier to handle.



Inside Trigger Handle

Preferred by some operators, the optional inside trigger handle prevents the possibility of the operator's hand being caught when the tool is used in extremely close quarters.

FREE! New Form 5248—describes the Ingersoll-Rand 834 Impactool in detail. Contains photos, specifications and lists standard and optional equipment and accessories.

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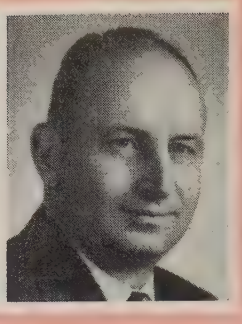
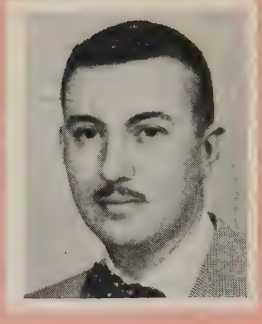
Tools plus AIRengineering increase output per man

DR. WALTER S. BAIRD
Chairman of the Board
Baird-Atomic Inc., Cambridge, Mass.

ALEXANDER L. GOBUS
Product Manager, Industrial Radiographic Equipment, Philips Electronics Inc., Mt. Vernon, N. Y.



WILLIAM D. KIEHLE
X-ray Div., Eastman Kodak Co.
Rochester, N. Y.



A. J. STEVENS
Vice President, General Manager
Nuclear Systems Div.
Budd Co., Philadelphia

1959 FORUM ON TECHNICAL PROGRESS

Inspection and Testing

Inspection Costs Can Be Cut By Direct Reading Analyzers

—DR. WALTER S. BAIRD

• Direct reading, optical emission spectrometers will be of interest in 1959. They can produce significant savings in the melt shop and quality control laboratory.

Results are delivered to the melt shop within 10 minutes. Heats are often shortened.

Off-analysis heats are virtually eliminated and expensive alloying elements conserved.

Improved instrument design eliminates the need for special labs, lowering capital investment.

Other recent direct reading advances include the analysis of phosphorous and boron in steel and improved analytical precision for heat resistant, tool grade, and other high alloy steels.

Combination direct reading and spectrographic instruments will add new dimensions to many quality control operations. The versatile spectrograph is combined with the speed and precision of direct reading for routine and repetitive problems. Rapid conversion is possible from photographic to photoelectric techniques.

New direct reading problems may be conveniently set up by the user.

Other developments: A direct thermal imaging device which detects hot spots on blast furnaces and reveals worn furnace linings. It also tests honeycomb bonding.

Faster, convenient, and more sensitive techniques for determining carbon and sulfur are on the way.

Image Intensifier Broadens X-Ray Applications

—ALEXANDER L. GOBUS

• An intensive effort is underway to find a substitute for industrial radiography. X-ray fluoroscopy was one attempt, but poor detail, operator fatigue, and the absolute necessity for darkness restricted its potential.

Today's imaging tubes have immeasurably broadened industrial fluoroscopy. They intensify a fluoroscopic image so you can see clearly without a lightproof fluoroscopic enclosure.

Coupled with an image intensifier, fluoroscopy has these advantages for present and potential users:

1. Production time can be cut by as much as 90 per cent.
2. Film costs are eliminated.
3. Goods in process inventory can be substantially reduced.

The immediate future should witness more feet of welding inspected per weldment.

New uses for x-rays formerly thought too expensive, due to film technique, will now be carefully considered.

Quicker, Easier X-ray Method Being Tested

—WILLIAM D. KIEHLE

• Strip x-ray films, 360 degree radiation equipment, and gamma-ray sources have already speeded up the radiographic examination of parts and products. Automatic equipment for high speed radiograph processing will incease production and result in products of higher quality.

Automatic processing equipment for handling large quantities of sheets and long strips of industrial x-ray film has already reached the tryout stage. Trade testing indicates that such equipment provides precise control, uniform quality, and some solution to trained personnel shortages.

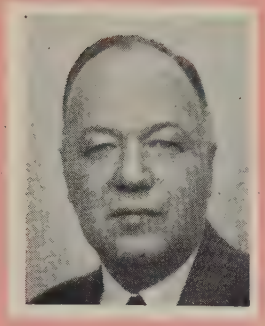
A new field for radiographic equipment is being surveyed: The inspection of welds in building and bridge construction.

New Method of Gamma Testing Needs No Film, Cuts Costs

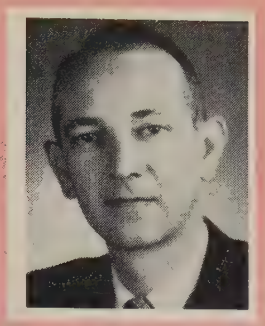
—A. J. STEVENS

• During 1959, we expect continued expanded use of the gamma radiograph, particularly where strong sources show their value.

During the last year, 1000 curie, cobalt 60 sources in radiography machines have proved their value in heavy castings, shipbuilding, heavy plate fabrica-

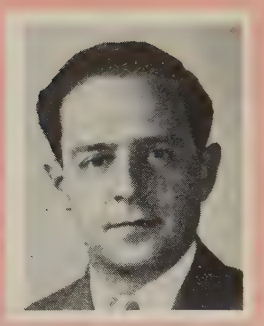


W. K. LONSDALE
Chief, Industrial X-ray
Herron Testing Laboratories Inc.
Cleveland



C. H. HASTINGS
Senior Scientist, Materials Section
Research & Advanced Development Div.
Avco Mfg. Corp., Wilmington, Mass.

W. C. HITT
Nondestructive Testing, Materials & Processes
Douglas Aircraft Co. Inc.
Santa Monica, Calif.



LOUIS A. WELT
President, Steel City Testing Machines Inc., Detroit

tion, and inspection of solid rocket propellents. The sources require exposure times only somewhat longer than those of 2 million volt x-ray machines. Above 5 in. of steel or equivalent, radiographic quality of cobalt 60 is appreciably superior to that of high voltage x-ray.

Thulium 170 machines should also extend the useful range of gamma radiography below ⅛ in. of steel equivalent, compared with about ¼ in. for iridium 192 today.

In addition, 1959 should mark the beginning of widespread use of noncontacting gamma thickness gages (particularly in hot-rolling mills). Scintillation counting has permitted high energy, gamma emitting isotopes which measure relatively thick sections of steel and other metals.

For the next few years, radiographic applications should double every year. In addition, gamma gaging should really come into its own.

Gamma probing, a relatively new method of nondestructive inspection, may supplant radiography in some areas. Although similar in principle to gamma gaging, the applications are much more closely related to radiography. Principal advantages: Elimination of film and the cost of processing. This system should be particularly valuable for inspecting centrifugally cast pipe.

Fluoroscope May Surpass X-ray Film in Inspection

—W. K. LONSDALE

• To meet the challenge of the missile age, x-ray tubes have been developed which can find the smallest flaw. In some, the focal spot area has been cut 99 per cent. Definition improvement is remarkable.

Today's fine grain x-ray film enables the radiographer to employ more sensitive techniques without increasing labor costs.

The near future will see the further development of fluoroscopic inspection with image intensifiers and closed circuit TV systems. The method is especially adaptable to semiautomatic inspection of large quantities of similar parts. Parts will be handled mechanically—technicians will do the scanning. Completely automatic inspection will come later.

The solution of one technological problem would greatly enhance the use of fluoroscopy: The development of fluors especially sensitive to gamma and high voltage x-rays.

Since it is desirable to penetrate the maximum possible thickness, the energy level must be high. Remote viewing by television is a distinct advantage as a means of maintaining safety of personnel.

Of course, the basic advantage of fluoroscopy (no film costs), remains as important as ever.

Standardization Slated for Major Role in Testing Progress

—C. H. HASTINGS

• Nondestructive testing's most urgent need is for greater appreciation by engineering management. Too many are as yet unaware of the relatively large cost savings being realized by new users.

In the next few years, we look for the greatest progress in standardization and specifications which prescribe the conduct of nondestructive tests. Such activities are being undertaken by: The Society for Nondestructive Testing, American Society for Testing Materials, American Society of Mechanical Engineers, Society for Automotive Engineers, Aircraft Industries Association, American Iron & Steel Institute, and trade associations with special subcommittees.

Standardization efforts emphasize the limitations of commercial equipment so you can expect better designs to appear. Look for such efforts eventually to provide tests which are quantitative, rather than qualitative, and for which reliabilities can be stated.

Testing Needs More Research, Training, and Better Standards

—W. C. HITT

• During 1959, aircraft companies will apply semiautomatic ultrasonic equipment to inspect metal to metal bonds (work toward establishing standards will be completed) and brazed honeycomb panels. Additional ultrasonic researchwork will be completed to establish aircraft reference standards for high strength steels and stainless alloys. Fatigue data will be accumulated and used to evaluate flaws found by ultrasonic testing.

Combined high voltage x-ray and ultrasonics may be the next major step in the reliability program of dry propellent missiles. The combination offers great potential for lack of bond, cracks, and voids.

In-motion x-ray, ultrasonics, and magnetic particle inspection will be widely used to test high strength steel alloys.

Mechanized eddy current ultrasonics and magnetic particle inspection of jet engine parts will be expanded during the next few years in manufacturing and overhaul.

The development of nondestructive testing techniques and equipment brings with it the problem of correlating the data obtained with actual measurements of strength and serviceability of the part or material. This may well be our greatest problem in the coming year. More emphasis must be placed on application research, standards, and personnel training.

Industry Must Find Way To Establish Standards Laboratory

—LOUIS A. WELT

• In the field of calibration, look for more interest in accuracy for force-measuring and load-measuring devices. (They are important to the missile and aircraft industries.) Such work is becoming too great for the National Bureau of Standards to handle alone and private organizations may have to establish their own

Inspection and Testing

J. E. REIDER
Manager, Metals & Mining Div.
Industrial Nucleonics Corp.
Columbus, Ohio

V. E. LYSAGHT
General Sales Manager
American Chain & Cable Co. Inc.
New York

FRANCIS G. TATNALL
Tatnall Measuring Systems Co.
Subsidiary of Budd Co.
Phoenixville, Pa.

calibration laboratories with intermediate standards such as our own optical proving rings.

Physical-property testing of metals is becoming more closely allied to production and production control. Testing has become easier and more nearly foolproof, and equipment will become more single-purpose rather than universal.

We don't expect basic equipment or methods to change for such qualities as hardness and tensile strength. Chief change will be on physical properties at elevated temperatures.

Coming: Marshaling of Plant Output Data in 15 Minutes

—J. E. REIDER

• Some time within the next decade, you will be able to read a report at 10:15 a.m. of your production and cost figures for the hour ended just 15 minutes previously. The report will contain information on prime material value, reject material value, raw material costs, labor overhead, and profit for the entire company. Such efficiency is the goal of our technology.

Business information delays of weeks or months must and can be shortened to minutes through production control systems. Automatic data processing equipment that not only records what is happening but constantly compares performance against goals will give management a tremendous lever against rising costs.

The higher income of Americans is also reflected in higher payrolls. It is generally accepted that such costs now amount to 45-55 per cent of the business total.

To obtain maximum performance at the least cost, management must be able to point out and correct immediately inefficient groups, departments, or practices with the same efficiency now obtained on machines with automatic feedback control.

New Device Checks Metal Hardness in 1500° F Furnace

—V. E. LYSAGHT

• Hardness testing is rapidly becoming a vital tool of modern metallurgy because of the growing relationship between product quality and hardness.

That has led to new and faster methods of mass production testing. Fully automatic machines can check 1000 pieces an hour.

Microhardness testing is gaining favor with metalworking people. It is the only way to measure the hardness of tips on cutting tools, watch springs, precision parts, superficially hardened surfaces, or sections 0.0005 in. thick.

There is a need for more microhardness testing to check and sort workpieces. This year will see the introduction of a high-capacity tester with a limited range of static indentation loads. It will greatly facilitate testing hard-to-handle metals.

Production hardness testing with statistical quality control is coming of age.

There has been need for a hand-operated unit to Rockwell and superficial test with a minimum of changeover time. Such an instrument is in use, and this year will see many advances.

When handling high temperature rocket metals, the metallurgist cannot afford to guess. A hot hardness tester has been developed which measures while inside an atmosphere furnace at 1500° F. Such tests will enable the engineer to follow the course of structural phenomena as metals are heated and dropped to room temperatures.

New Stress Indicator Changes Color To Show Strain Pattern

—FRANCIS G. TATNALL

• The next few years will see a need for reliable methods of measuring strain, load, pressure, and torque at high and low temperatures, shock, vibration, erosion, and corrosion. Means of achieving such goals are in sight: Load and pressure cells, torquemeters, accelerometers, and strain gages will be stable at 1000° F or better. Pedigreed strain gages make that possible.

A pedigreed strain gage is one which has been thoroughly evaluated under temperature cycling, thermal stress, and all environmental conditions. It is the only satisfactory way of measuring thermal stress.

Other problems are the cements and metal gage covers. They must resist temperature, moisture, erosion, oxidation, and mechanical damage, yet be fluid enough to be brushed.

Another new technique is Photostress. It is a photoelastic coating that turns strain into color and provides a complete visual pattern of strain distribution. The pattern is read by instruments which turn color into electrical signals for accurate readout.

The system dramatically reveals strain concentrations, notches, pits, structural misalignments, and dynamic variables. It can be used at or near room temperature, is not affected by water or other fluids, is responsive to the severest impact and high frequency dynamic strains, and will freeze in the complete strain pattern around a fracture.

Suggests Nondestructive Test To Aid Nuclear Progress

—WARREN J. McGONNAGLE

• Rapid progress has been made in the development of adequate instrumentation for nondestructive testing in the nuclear energy field. However, I predict that eddy current testing will make the biggest advance in the next few years. It is beginning to emerge as a useful testing tool because of fundamental study and instrumentation advances.

Nuclear engineers are demanding more of old and new materials. To learn more about them without decreasing the safety factor, new techniques must be developed to find deficiencies. Engineer-

(*Please turn to page* 282)

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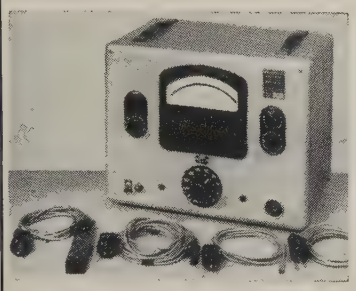
offers you industry's broadest range of testing systems and equipment for nondestructive testing



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An extremely sensitive eddy current measuring instrument for DC magnetic fields. Used for many applications in geophysics, magnetic investigations, military use and in nondestructive testing of magnetic materials. Responds to steady state fields and the field of direct current. Measures weak fields in presence of stray fields and determines amount of residual field remaining in a piece after demagnetization.

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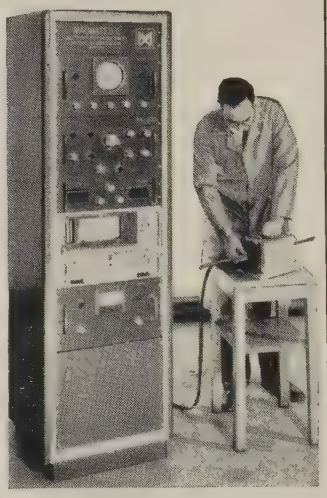
Detects seams, cracks, concentrated porosity, inclusions, stringers, laps and splits automatically Finds diameter variation, embrittled areas and scale. Provides completely automatic, high speed production of copper tubing. Inspects aluminum rod for voids, scale and other conditions which cause trouble in drawing or final wire. Designed for heavy industrial use.



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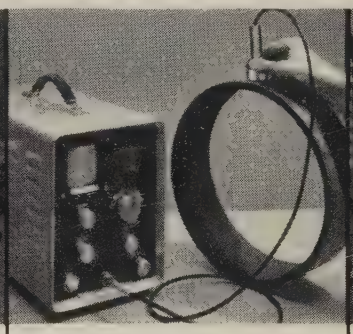
Chiefly for nonmagnetics for defects open to the surface. Fluorescent penetrant, black light. Practically any volume and speed required. Controlled sensitivity. Also portable kits and leak tests.



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Ultrasonically measures thickness from one side only in tank walls, cast, formed or welded products, etc. Also discovers sub-surface defects, laminations and lack of bond.

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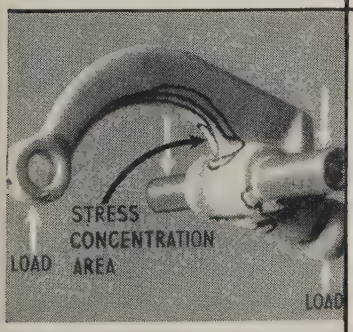
Electronic eddy current instruments. Numerous types with industry-wide application. Conductivity, magnetic fields, dimension, hardness, alloy, coating thickness, cracks, etc.



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Brittle coating stress analysis tool. Helps in designing stronger parts with less weight. Shows stress distribution, direction, and stress level over entire part.

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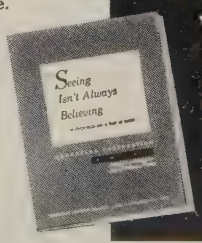

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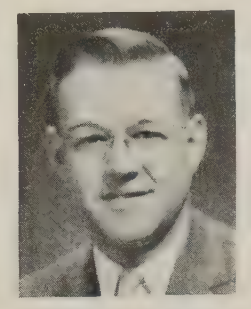


WARREN J. McGONNAGLE
Group Leader, Nondestructive Testing
Argonne National Laboratory
Lemont, Ill.

HAMILTON MIGEL
Vice President, Engineering & Research
Magnaflux Corp., Chicago

ing data are needed to correlate physical and mechanical properties with testing results. In addition, we need realistic standards and procedures.

One of our major problems is achieving economical or competitive nuclear power. If that goal is to be achieved, fuel elements must have a long useful life in the reactor. Nondestructive testing can contribute much toward that goal, but there is a need for fundamental research and development.

Magnetic Particle Inspection Will Win New Uses

—HAMILTON MIGEL

• In 1959, the steel industry will greatly expand Magnaglo inspection of semi-finished mill products. Part of the reason is a new fluorescent magnetic particle which is flowed over a magnetized part in water suspension. When viewed under black light, they produce brilliant indications of otherwise invisible cracks or seams.

Teamed with semiautomatic conveyors, the system processes 400 tons an hour. (Billets are 5 in. square, 35 ft long.)

The technique has two basic advantages: It eliminates pickling, visual inspection, and billet skinning which removes a lot of good material; it reduces scrap or unsatisfactory material.

That kind of inspection, combined with spot conditioning, has increased yields some 4 per cent. That amounts to about $4 a ton.

Two mills have Magnaglo installations. Two more are being installed. Several others will be completed in 1959.

Studies now being made indicate that Magnaglo will work on slab conditioning in plate, sheet, and strip mills, with comparable savings.

Eddy current inspection is finding favor as a production test for finished steel products for metallurgical variations in finished steel products. Forged automotive connecting rods are being checked by low frequency eddy current equipment to control heat treatment. Bearing balls and races are being automatically tested for hardness. Rate: 10,000 an hour.

Neutron Radiography Could Improve Missile Inspection

—E. ALFRED BURRILL

• The Space Age has created inspection problems that are beyond those of the more "mature" nuclear types.

New materials have to be inspected: Solid rocket propellents, missile assemblies, Pyroceram components, missile frameworks, and envelopes.

Missiles require a new concept of quality control: They must be perfect when first fired. That means extremely rigid inspection procedures. Nuclear systems al-

ready require the exploitation of nondestructive testing to the fullest. Precision radiography, with supervoltage penetrating power, will be increasingly utilized.

Present limits of radiography will be pushed back by 10 million electron volt x-ray generators like the microwave electron accelerators. They will inspect thicker steel, bulkier rocket propellents at higher exposure speeds.

With tomorrow's unusual materials will come more suitable methods of inspection. Neutron radiography is untried but promising. Light materials absorb neutrons to a greater degree than heavy ones, somewhat the reverse of x-ray absorption processes. The method could prove valuable in nuclear and missile inspection. Relatively compact particle accelerators can provide the powerful neutron sources for this type inspection.

There is an urgent need for greater recognition of a nondestructive testing engineer. During the next few years, educators and industrialists will recognize this field as a profession rather than a technique.

Greater Emphasis on Quality Expands Nondestructive Test

—JOHN C. SMACK

• Increasing demand for more reliability in nuclear reactors, rockets, missiles, and supersonic airplanes means greater emphasis on nondestructive tests in 1959. Effectiveness will be affected by quality control in other industries.

For 14 years, there has been fast improvement in metal processing which has been matched by continuous improvement of test instruments.

Quality control is important to the survival of this nation. Failure of important missiles or combat aircraft at a crucial moment could be fatal.

Further automation of ultrasonic immersion testing and some applications of contact testing are a must. Requirements for the recording of 100 per cent testing have resulted in flexible recording systems, such as electrosensitive paper records 30 in. wide. We expect they will be used extensively in 1959.

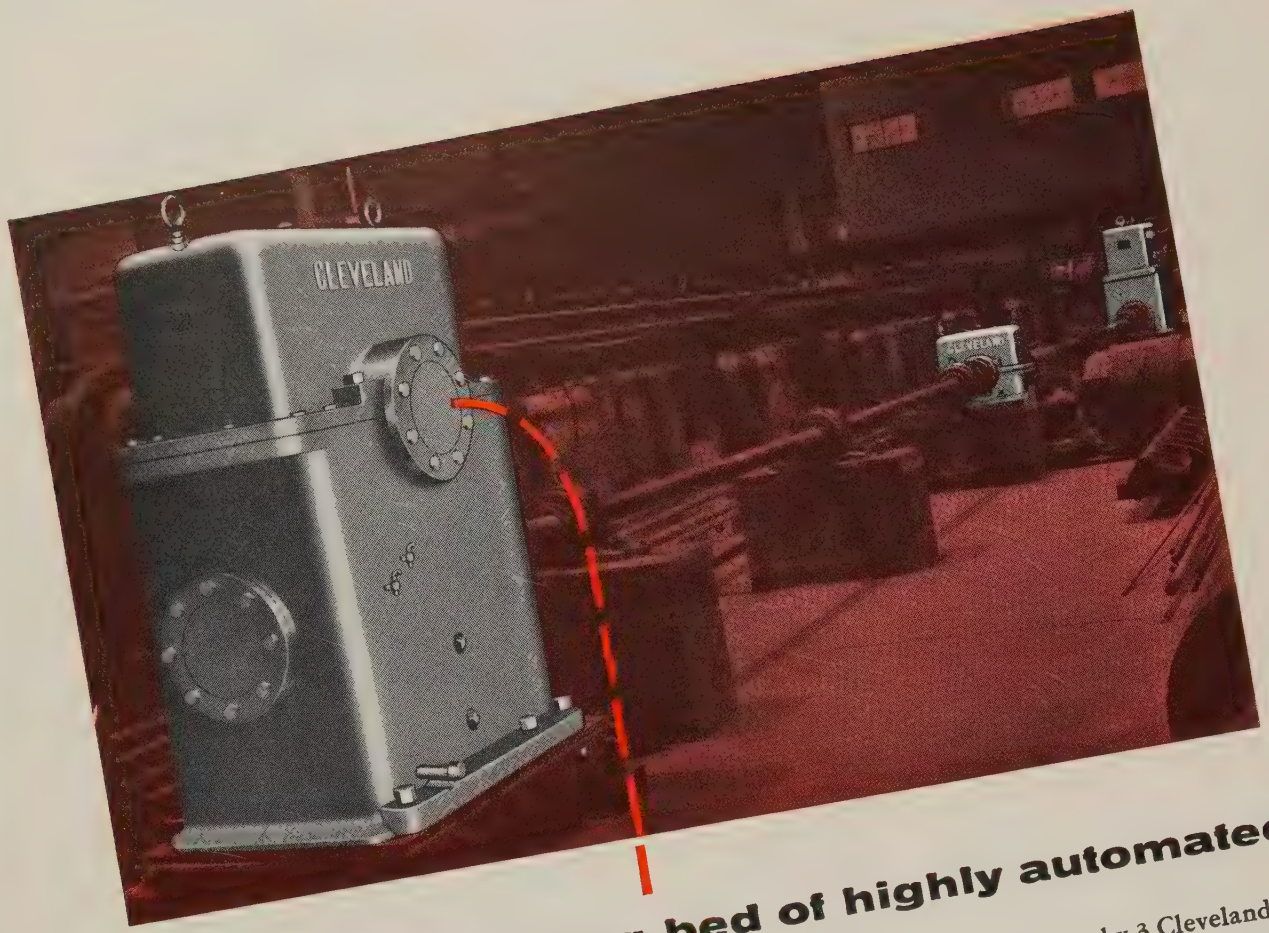
Simplification of test equipment is progressing application by application. An example is the single-frequency ultrasonic tester complete with defect signals and a multiple transducer for finding fatigue cracks in freight car axle journals. Results: Smaller and fewer controls and elimination of operator interpretation. It costs less, is faster, and more efficient. By 1960 and 1961, look for many other specialized ultrasonic test instruments.

The need for operator judgment will be reduced with automatic electronic analyzing circuits and improved knowledge of metals.

Inspection and Testing

E. ALFRED BURRILL
Vice President and Sales Manager
High Voltage Engineering Corp.
Burlington, Mass.

JOHN C. SMACK
Staff Asst. to General Manager
Princeton Div., Curtiss-Wright Corp.
Princeton, N. J.



Clevelands drive cooling bed of highly automated Canadian tube mill

Here is the cooling bed—driven by 3 Cleveland speed reducers—of the world's first completely automated seamless tube mill. It was built by Mannesmann-Meer Engineering & Construction Co., Inc., Easton, Pa., and installed at the Sault Ste. Marie plant of Mannesmann Tube Company.

Practically everything in the entire plant is automatic—handling of materials from stage to stage, as well as individual operations.

You'll find Clevelands in nearly every steel plant in America—wherever dependable, heavy duty drives are demanded—many of them in continuous service upward of 35 years. Write for new Bulletin 145 which shows the many types available in the Cleveland line. The Cleveland Worm and Gear Company, 3270 East 80th Street, Cleveland 4, Ohio.

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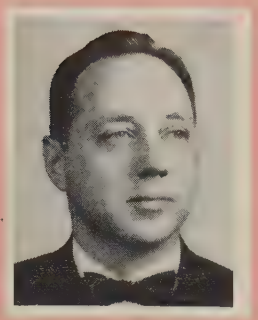
J. M. COOK
Vice President—Marketing
Cutler-Hammer Inc., Milwaukee

JOHN C. SEARS
Executive Secretary, American Gear Manufacturers Assn., Washington



P. D. ROSS
Manager—Marketing, Direct Current Motor & Generator Dept., General Electric Co., Erie, Pa.

JOSEPH E. OTIS JR.
President, Dodge Mfg. Corp.
Mishawaka, Ind.

1959 FORUM ON TECHNICAL PROGRESS

Drives and Controls

Better Transducers Needed For Feedback Functions

—J. M. COOK

• The static rectifier package is assuming prominence in converting alternating current power to controlled direct current for driving and speed regulating motors on individual machines as well as complete processing lines.

A continuing trend toward increased production through high speed automatic operation demands better and more sophisticated control of speed, tension, and accelerating forces.

Specialized control system requirements are no longer the exception—this applies to new equipment designs as well as the modification of process lines. New products and new engineering techniques will continue to be required in abundance. New and better transducers to feed back more reliable and more precise measurement information to the controller are needed now.

Standards for Gear Strength, Durability Nearly Completed

—JOHN C. SEARS

• Manufacturers of enclosed drives are continuing their efforts to build more horsepower into smaller packages.

Demand for closer tolerance gearing remains unabated. We have the tools and knowhow to produce but must necessarily remain within the accuracy limits of available inspection equipment.

Certain gear applications in atomic energy, unmanned aircraft, and missiles are slow in developing because of unsolved problems.

The German DIN and Japanese gear classification data are occupying much of our attention. A project now underway should in the not too far distant future produce comparable data, tailored to U. S. gear design and manufacturing methods.

It is anticipated that the data will be presented to the gear buying public in the form of a standard on purchasing specifications.

Another AGMA project that is well on its way to completion is "standardizing" gear strength and durability formulas. These data will, for the first time, give designers every now known factor that affects the strength and durability of a gear.

Electrical Developments Coming in Metalworking

—P. D. ROSS

• Direct current adjustable speed drives, using new power conversion techniques, promise increased efficiency and reduced maintenance in machine tool and mill auxiliary applications.

Improved sensing devices to supply anticipatory corrective signals in automated systems are being developed. It is expected that such devices will result in substantially improved quality and reduced costs in primary metal production and automated machining.

Programmed machine tools are assuming increasing importance in the mechanization of job shop operations.

Data logging equipment will improve the knowledge and understanding of steelmaking. Computers will be used increasingly to determine improved techniques. Growing utilization and effectiveness of programming will be of vital consequence in the further automation of the steelmaking process.

Looking farther ahead, the electrical industry is doing important and potentially far-reaching research into basic energy sources. Long range projects are concerned with investigation of unconventional energy sources such as thermionic generators, fuel cells, solar batteries, and nuclear-thermal batteries.

Belt Drives Getting Smaller, Use Less Space

—JOSEPH E. OTIS JR.

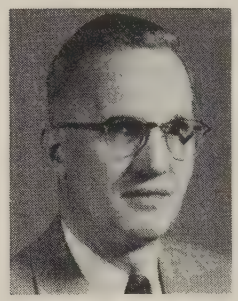
• Economy of weight and space are the prime objectives in the design of new power transmission equipment.

To save power, prolong the life of costly machinery, and avoid wasteful downtime for repairs, industry will be using new devices to cushion mechanical

Drives and Controls

JOHN V. EAKIN
Vice President, Fawick Airflex Div., Fawick Corp., Cleveland

W. C. DENISON
President, Denison Engineering Div. American Brake Shoe Co. Columbus, Ohio



E. H. BROWNING
Manager, Metal Working Section Industrial Engineering Dept. Westinghouse Electric Corp. East Pittsburgh, Pa.

ROBERT H. HOGE
President, Clark Controller Co. Cleveland

starts and to reduce wear and tear on belts, gears, and other moving parts.

Use of controlled acceleration devices like dry fluid drives and couplings by makers of processing equipment and conveyors will increase. Besides affording overload protection to machinery and motors, such drives and couplings will reduce waste in the processing of fragile materials like thread and wire.

An outstanding development in power transmission this year will be the introduction of V-belt drives that feature smaller, lighter, and stronger sheaves and belts (Dodge's Dyna-V line). The drives will enable engineers to design more power into less space.

Space saving considerations will also dictate the use of more shaft-mounted speed reducers for both industrial and original equipment applications. New reducers will deliver higher horsepower than any previously available for mounting on shafts. New reduction ratios and special purpose adaptations, like screw conveyor drives, are developments to watch in the speed reducer field.

Maintenance costs in many plants are being reduced substantially with new shaft couplings which require no lubrication and will compensate for more misalignment than conventional types for longer periods.

Faster Speeds Create Press Safety Problems

—JOHN V. EAKIN

• Two significant trends in metalworking will have an impact on the design and operation of clutch coupled drives: 1. The emphasis on faster speeds and greater accuracy. 2. The desire for increased operational safety for the machine and operator. Both problems are tied to the growth of automation.

With higher speeds and greater precision, machine operation becomes more hazardous. Accidental operation of a press can damage expensive dies, cause costly downtime that might cripple an integrated automatic operation, or injure the operator.

One approach is a new control system, developed by Fawick and Textrol Inc. It has two identical sets of components that monitor each other for failures. When one component fails, the system stops the machine and prevents operation until the failure is repaired. Repair of the control system is infinitely faster and simpler than repairing the machine or dies.

Product Research Will Spur Shift to Hydraulic Equipment

—W. C. DENISON

• Industry will continue to emphasize the trimming of production and processing costs this year.

Research will play a big part in the effort. With new industrial horizons constantly dawning as a result of fundamental research, applied product research must be stepped up to bring the benefits of this work to our industrial economy.

We will step up our research during 1959. The increased use of hydraulic equipment in automated installations will be one of our major targets.

Metalworking Will Use More Digital Programming Controls

—E. H. BROWNING

• An extension of digital programming controls in metalworking is a certainty. The near future will see improvements and additions to further improve process productivity and product quality. Computing stages eventually will do most of the work now done by the human programmer.

Most of the high quality process controls in metalworking employ static magnetic amplifier types of regulating devices. The next phase will be the substitution in many cases of digital types of controls to give even better results than are possible or practical with the familiar analog forms of regulating systems.

Another area in which considerable work is being done involves the accumulation, logging, read-out, and treatment of process data. Such systems will be aimed toward permitting quick over-all appraisals of process operation by making available all the data necessary to effect a valid decision. Further, such systems will permit feeding back such treated data into the process controls and in effect will result in the incorporation of the product itself into a closed loop control system.

Static Devices Will Promote More Automatic Processes

—ROBERT H. HOGE

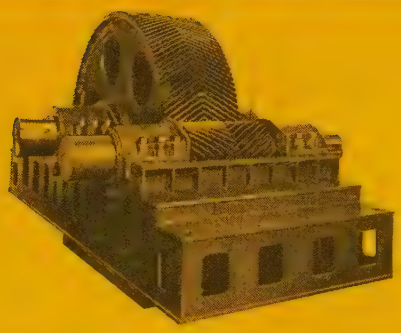
• We believe the greatest innovations in industrial control will come from the application of static devices.

It is not necessarily true that static devices will replace the conventional electromechanical devices that might be referred to as conventional controls. In many cases, transistors will replace relays. Magnetic amplifiers will be doing the work done by contactors and relays in some applications.

Static and electromechanical devices are not altogether competitive; they are often supplementary. We believe greater use of static devices will lead to more automatic processes that will increase the demand for electromechanical devices.

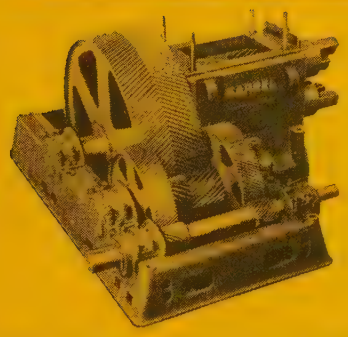
Larger crystals must be grown to increase the capacity of transistors applied to power circuits. Also, progress is needed in the design and manufacturing meth-

SPECIAL DRIVES FOR SPECIAL JOBS



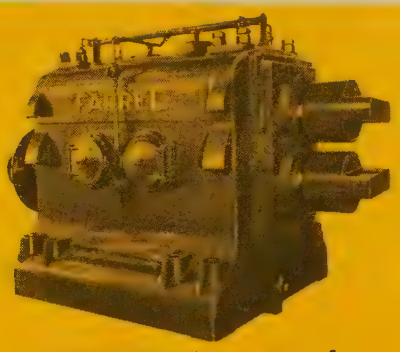
5500 HP Single Reduction Unit

Herringbone geared reduction unit designed to transmit power to a 134" three-high sheared plate mill, reducing motor speed from 375 to 70.35 RPM.



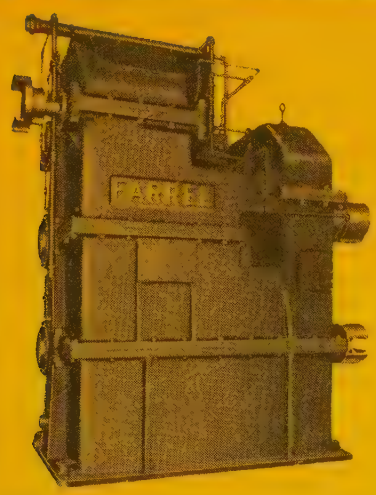
1000 HP Combined Drive and Pinion Stand

Designed to transmit power to a two-high cold brass run-down mill. The first reduction gears are opposed single helical. The second reduction gears and the mill pinions are Farrel-Sykes continuous-tooth herringbone.



2000 HP Pinion Stand

21" pinion stand, designed to transmit power to a four-high aluminum sheet mill. Heat-treated, forged steel pinions are continuous tooth herringbone, generated by the Farrel-Sykes process.



150 HP Triple Reduction Unit

The three pairs of continuous-tooth herringbone gears of this special tube mill drive provide a ratio of 113 to 1. A pinion unit is built as an integral part of the drive.

Whatever your mill drive requirements, no matter how unusual in design, size or capacity, Farrel will meet them. As in the examples given, each unit is individually engineered for the application.

Each Farrel unit is designed to assure top drive efficiency, plus the strength to withstand the shocks, stresses and wear encountered in continuous, heavy duty service.

Gear drives are made with herringbone, single helical, or a combination of single and double helical gears. Pinions are usually herringbone type, although single helical pinions may be supplied. Gears and pinions are precision-generated by the famous Farrel-Sykes process, assuring accuracy of tooth spacing, profile and helix angle. Result: High efficiency and smooth, quiet operation.

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Drives and Controls

C. C. LIBBY
Manager, Electrical Dept., Fairbanks, Morse & Co., Fair Lawn, N. J.

T. H. BLOODWORTH
Chief Systems Engineer, Electrical Application Dept., Industrial Equipment Div., Allis-Chalmers Mfg. Co., Milwaukee

WILLIAM A. THOMAS
Vice President—Engineering Electric Products Co., Cleveland

ods of magnetic amplifiers to bring these devices into the economic range of many applications.

Application engineers are using the devices, as they are developed, in the solution of more control problems. In this application work, problems of design in the components are coming to light, and better transistors and magnetic amplifiers are being produced.

New Insulating Materials Will Widen Motor Potential

—C. C. LIBBY

• New motor designs will be influenced to a greater degree by new insulating materials than any other single factor.

Such materials as the silicones, epoxies, and alkyds will be used in combination with traditional Class A and B insulations. They will provide resistance to attack by a variety of atmospheric contaminants and will permit new combinations of motor size, temperature rise, overload capacity, and enclosure without a reduction in the life expectancy of the motor winding.

To make full use of new insulation capabilities, a simple, accurate and relatively quick test and evaluation procedure is needed. Prediction of insulation performance and probable life under field conditions and translation of ambient-load conditions into measurable performance requirements are necessary.

A second major development is the acceleration of the trend toward integral design of the motor and driven machine. In sizes up to 100 hp, motor and load will become increasingly identified in mechanical design, employing such features as a common shaft, ventilation, lubrication, bearings.

Motors may be designed for specific load conditions to utilize maximum capacity of active materials with minimum motor weight and without regard to generally applicable service factors.

Static Power and Control Coming to Steel Industry

—T. H. BLOODWORTH

• Emphasis in the metals industry this year will be on the upgrading of facilities to obtain increased tonnages at lower cost per ton.

Hot-strip mills will be updated by coupling new motors to the shafts of the drive motors. Mercury arc rectifiers, operating in parallel with direct current generators, will meet control and added power requirements.

The first feedback control system for automatic gage regulation on the finishing stands of a hot-strip mill will be put in operation early this year. Punched card programming is not included but can be added. Data logging equipment provides information on off-gage or other defects in the finished product.

Emphasis in cold metal facilities will be on tempering and processing work. Maximum speeds of tin temper mills will be increased with improved regulating systems.

Application of static power supplies for mill auxiliary drives will increase, both in numbers and horsepower ratings. Semiconductor rectifiers for electrolytic tin plating will gain increased acceptance. Introduction of the power transistor or controlled static rectifier in ratings comparable to today's diodes will greatly accelerate this trend.

Static, 250 volt mill supply power, with unit ratings of 1000 kw and 1500 kw will be installed this year. Designs are based on operating experience obtained from successful lower powered installations.

Expanding availability and usage of static power and control elements and systems will have the greatest impact on industry in the next few years. Semiconductor manufacturing techniques must be mastered to increase the yield of high voltage diodes and furnish greater uniformity of product.

Semiconductor triode developments will take several years to reach a proficiency comparable to today's diodes. Static devices for switching high power direct current systems are needed.

Coming: Better Generators, Adjustable Speed Drives

—WILLIAM A. THOMAS

• Many developments have never reached their full potential. One example is the gas turbine. The high speed device has been held back because electrical generators are limited to 3600 rpm at 60 cycles and must be coupled to the turbine by a set of gears.

But we can expect a breakthrough in the near future. We are now able to obtain 60 cycles, or any other frequency, from power sources which operate at 6000, 12,000, and even 24,000 rpm. These generators give great promise for obtaining electrical energy from higher speed sources.

Providing excitation for motors and generators has always been a seemingly wasteful requirement. We now have excellent permanent magnets, and significant improvements are on the horizon. Means are available to build Alnico magnets into generators as flux sources without paying a heavy premium.

Recent technical developments have improved design methods to fully utilize the permanent magnets, and there are effective means of controlling voltage in such a generator.

We look for these developments to

Drives and Controls

FRANK H. FORD
Assistant Manager, Marketing Dept.
Turbo-Products Div., Clark Bros. Co.
Division of Dresser Operations Inc.
Olean, N. Y.

radically change the picture in such units as aircraft generators, engine driven generators, motor-generator sets, and other suitable applications. We can add supplementary excitation sources for motors and generators through the use of power transistors.

Ward-Leonard direct current motors have dominated adjustable speed drives for years. On the horizon are many varieties of alternating current, adjustable speed motors with superior characteristics. These motors combine the rotating element with the proper control circuit, using thyratrons, power transistors, and magnetic amplifiers to accomplish the required end. Progress in these units will be rapid.

In the next few years, we will have a gradual return to the all alternating current system. Light, high temperature, efficient, high speed, exciterless generators will deliver at any desired frequency to efficient adjustable speed alternating current motors. They will be accurately controlled to fit in the pattern of automation.

Use of Waste Heat Boosts Gas Turbine Efficiency

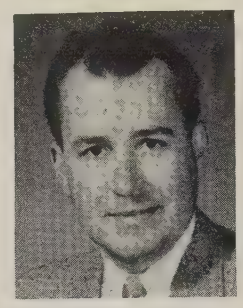
—FRANK H. FORD

• With improved materials and techniques, the gas turbine will become more important in the power picture.

Industry is beginning to realize the potential of the prime mover, particularly when the heat in the exhaust gas can be utilized. Such utilization increases the over-all plant efficiency, and many times (as in some process industries) provides the only economical means of obtaining the required plant steam and power balance.

Exhaust gas heat has been used for a multitude of purposes, from heating and

Drives and Controls



ROBERT O. GEE
Manager of Application Engineering
Reliance Electric & Engineering Co.
Cleveland

drying to absorption type refrigeration.

Gas turbines are being used as the sole power source for complete industrial and process plants, where the entire output of the operation depends on their reliability.

Look for More Automation of Handling, Process Controls

—ROBERT O. GEE

• General automation practices are on the increase. Look for more conveyors with automatic controls to carry materials through the manufacturing process.

Automatic process controls are coming into their own. Any measurable process variable—tension, speed, pressure, fluid flow, pH, temperature—can be translated into electrical signals, amplified, and fed into special controls that are being built. The controls will then automatically govern the performance of single or multiple processes. The advantages: Greater production speed, consistent product quality.

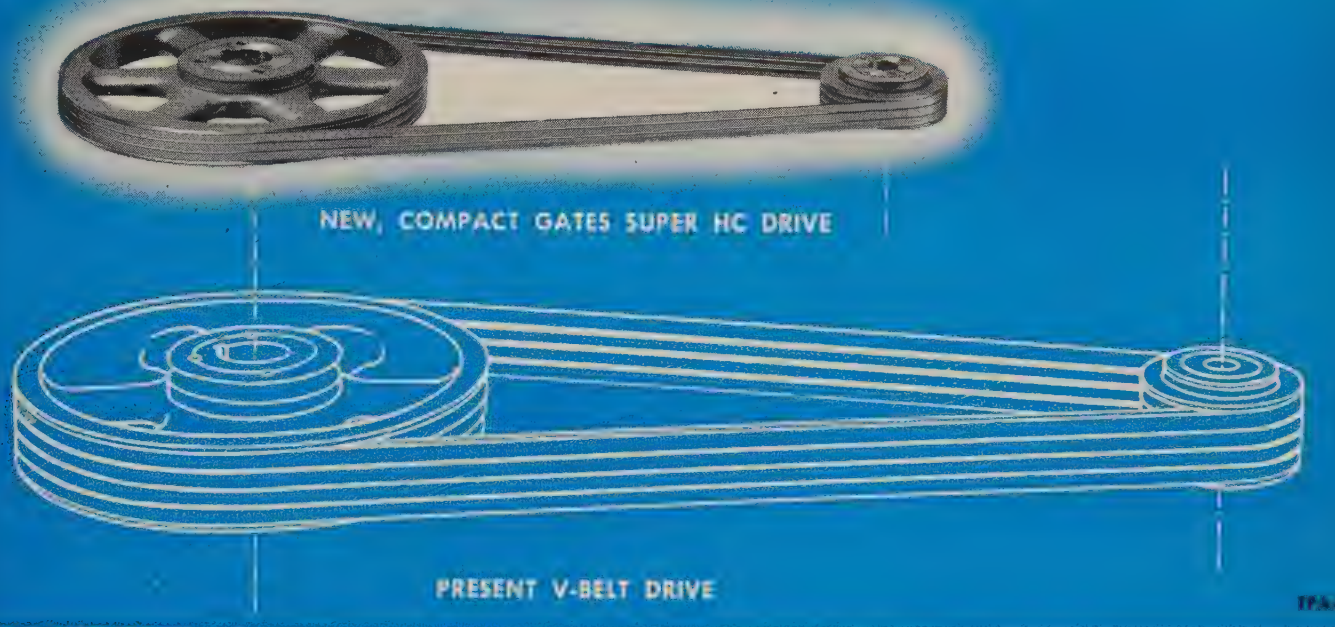
The producer likes it because it saves him the bother of slitting, cutting, sorting, and shipping by box. The customer likes it because he gets his order faster in coil form.

Even more savings can be realized by data logging. Tapes will be used to control line speeds and screwdown pressures.

You'll have more space in your plant for operating machinery due to smaller drives and motor controls. New insulation and ventilation have allowed us to package standard, rotating motor controls into cabinets 35 per cent smaller than previous units of the same rating.

Small, compact control cabinets and new enclosures for motors and controls permit putting the control units at or near the process lines. That approach eliminates long conduit or bus duct runs, and separate rooms or excavations for control units and motor-generator sets.

New high capacity V-belt revolutionizes drive design



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HENRY P. CHAPLIN
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Cone Automatic Machine Co. Inc.
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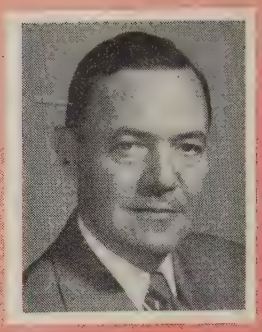
MARVIN R. ANDERSON
President
Michigan Tool Co.
Detroit



ROBERT W. HANCOCK
President
Hancock Industries Inc.
Jackson, Mich.

1959 FORUM ON TECHNICAL PROGRESS

Machining

Broaching Gets Ready For 'Soaring Sixties'

—JOSEPH P. CROSBY

• In 1959, the threshold year, broaching will lead the way for the next decade's new developments in machining of metals. In a recent survey, it was shown that broaching machines had improved their productivity more than any other machine tool in the industry.

This year, manufacturers will look for the machine tool that can give them the highest productivity at lowest cost.

Advances in electromechanical, horizontal, vertical, and continuous, high speed broaching machines (adaptable for carbide broaches) will have tremendous impact. Today's machines have built-in automation and repetitive accuracy; they handle most of the exotic metals now being used.

Design Changes in Automatics Needed To Reduce Downtime

—HENRY P. CHAPLIN

• Users of multiple spindle automatics will continue to seek means of reducing production costs. It is equally certain that in machine selection they will not overlook values that lessen downtime in these main categories: Job change, perishable tool change, stock loading, lubrication, and other machine maintenance.

It is not logical to expect the total requirements to be effectively met by only a few models. Effective job change facility must start with machine design. In addition to the usual job change features, there is need of better established reference points on machines to facilitate faster and more accurate location of tools and toolholders. Machine maintenance is also considerably dependent on machine design, particularly as it affects accessibility of replaceable parts and quality control in the machine's manufacture.

Two other downtime reducing provisions are: A controlled method of preset, quick change tooling, and a continuous type of stock feed. More self-loading bar stock reels, some of which load from the side to permit the use of extra long bars, may also be expected.

Problem of Productivity Sparks Process Development

—MARVIN R. ANDERSON

• Metalworking's basic problem will continue to be greater productivity to keep prices in line and compensate for still-rising labor costs.

The recession-imposed curb on capital investment brought several cost-saving methods into sharp focus, including development of more productive processes, the automating of existing machines, and increased emphasis on tool convertibility and salvage. In spite of today's improving industrial climate, such developments will continue to attract attention.

The upsurge in research and development activities will continue. Not only new processes but improvements in already accepted ones will result. A good example of this is our process for gear forming by cold displacement of metal. Recent research projects indicate even wider applications of the process by adapting it to hot forming and small-run roll forming.

Automation, too, will go on unabated but in a somewhat different fashion. Output is no longer the main requirement. Flexibility and high precision will be given increased consideration. Look for automation to be aimed at product families rather than single-product types. Automation in-process gaging is also expected to become increasingly important.

Cutting Nonproductive Time Opens New Equipment Field

—ROBERT W. HANCOCK

• Increased attention is being given to eliminating all possible nonproductive costs. Among these: Unnecessary downtime with accompanying idle time of both

RALPH J. KRAUT
President
Giddings & Lewis Machine Tool Co.
Fond du Lac, Wis.

D. E. HAWKINSON
Vice President
Greenlee Bros. & Co.
Rockford, Ill.

H. GLEN BIXBY
President
Ex-Cell-O Corp.
Detroit

HOWARD N. MAYNARD
President
Snyder Corp.
Detroit

machines and men, excessive supervisory costs, inefficient use of maintenance and setup personnel, excessive time and paperwork required in timekeeping, and inefficient production planning and control.

The record shows that the ratio of nonproductive to direct production labor costs has been rising at a fast rate in practically every industry. In some cases, the ratio has more than doubled in the last decade. Lack of attention to unproductive labor costs is one of the reasons why anticipated increases in over-all plant productivity have not materialized. Certainly, over-all productivity improvement has not kept pace with expanding capacity to produce.

We had to devise our own equipment to enable us to make more efficient use of both our personnel and equipment. The savings have been enormous. In less than a year of operation the equipment more than repaid its entire cost, and the savings are still growing.

In addition, the interest in what we had accomplished through simple and low cost communications and centralized control equipment became so intense that we were practically forced into establishing a separate division (Telecontrol Div.) to make similar equipment available to other companies.

Future Looks Bright For Numerical Control

—RALPH J. KRAUT

• There are a lot of bright spots in the future for builders who have followed a sound practice of new product development, personnel training, and upgrading of manufacturing facilities.

Many new processes and products, such as chipless shaping, rolling of splines and gears, Flo-turning, precision casting, sintered casting, electric discharge and electrochemical machining, and numerically controlled machines are coming into being.

We are especially bullish on the future of numerical control. Few people have realized the real meaning of this breakthrough. As in all new processes, the maximum benefit accrues by a redesign of the product to fit the manufacturing process. A whole new family of cutting tools will be generated by numerically controlled machining and automatic tool changing. Tools that cut longer, hold size closer, and can be readjusted to diameter and axial interchangeability after sharpening will be necessary. Some throwaway tool systems will be found economical.

Tool Builders Meet Challenge Of New Materials, Processes

—D. E. HAWKINSON

• Industry will move forward in 1959 with a great variety of new products, all designed to take advantage of new materials and processes perfected during the pause of the last several years.

New alloys and techniques will spur the use of aluminum diecastings and extrusions for a great number of functional parts. Cast to close tolerances and replacing ferrous castings and forgings, these parts will have a decided impact upon the machine tool industry. Methods of locating, handling, and machining this type of part must be carefully studied by the machine tool designer.

On many parts, the one-time dream of automation from molten metal to finished part could be a reality in the near future.

Flexibility Cited as Must in Extending Automation Market

—H. GLEN BIXBY

• The news in automation is increased flexibility. Some of the first automated machines were single-purpose specials that turned into white elephants as soon as their original purpose was fulfilled. That doesn't happen now because automated production lines are composed substantially of standard units that can be rearranged again and again for part changes or for accommodating new parts. We are confident that this flexibility is a feature that will help us sell automated machines to businesses that otherwise would not consider them. Production in most industries cannot and need not justify the expenditure required for a machine that might be good for only a couple of years. Our market for automation will grow in relation to the adaptability we can build into our automated machines.

What about numerical control? We believe its use will expand rapidly within well-defined areas. It offers few advantages in mass production as we think of it in the automotive, refrigeration, or electrical industries, but it will be useful in making dies, cams, tooling, and prototypes in these industries. It will find increasing use in aircraft production, where large, complicated, and expensive jigs and fixtures can be replaced by compact rolls of tape that are easy to handle and easy to store.

Numerical control will not replace tracer or cam controlled machines, but will make the tracer template and cams at a fraction of their former cost and to the highest degree of accuracy. Complicated prototype parts will be made by numerically controlled machines without the use of special tooling and highly skilled operators.

Combination-Operation Specials Answer Cry for Flexibility

- HOWARD N. MAYNARD

• Since World War II, the addition of new production equipment and processes has enabled industry to temper some-

(*Please turn to Page* 298)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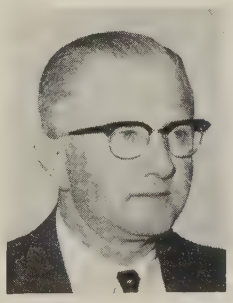

ALAN C. MATTISON
President
Mattison Machine Works
Rockford, Ill.

H. C. DAUM
Manager, Machining Process Dept.
Ford Motor Co.
Dearborn, Mich.

what the product price increases resulting from continually increasing labor costs. This trend is one that a manufacturer must continue to stay in business.

There are still many areas in metalworking production where costs can be cut by installing new and improved types of specialized machine tools. Example: The railroad industry cut costs by modernizing its machining processes.

Combination-operation special machines usually offer metalworking plants the most significant savings today. Special machines now being quoted and built fall mainly in this category.

The basic designs and components for these specials, such as rotary index and center column types, have been developed and proved by builders. These machines can economically handle a variety of parts and thus can be easily adapted to meet the production needs of manufacturers in the small lot and medium production ranges.

Most machine tool builders agree that the automotive industry now has adequate transfer-type machine tools to meet their requirements within their present product design concepts. Unless designs are drastically changed, it seems reasonable to assume that most of the transfer machine construction in 1959 will be in the area of rebuilding to meet more or less minor design changes. The majority of these transfer machines are of combination unit construction and can be economically rebuilt.

Two Challenges Spur Machine Developments

—WALTER K. BAILEY

• Two major factors are accelerating invention and product development in the U. S. machine tool industry: First, the imperative need in metalworking to offset higher wages by reducing production costs. Second, the competition of lower priced, European built machine tools.

It is generally assumed that the most significant progress will be made in numerical control. The machine tool industry is working diligently to bring the cost of numerical controls down to levels of broad, practical use.

The price problem presented by imports is important, of course; but it is nothing new. American machine tools have always cost more than comparable foreign makes. But people have preferred American machines because they outranked foreign machines in design and performance. But many of today's foreign machines are coming dangerously close to ours in those areas. To maintain our advantage, we must again outengineer and outdesign our foreign competition.

Surface Grinding Aims To Boost Part Quality

—ALAN C. MATTISON

• Surface grinding has made notable advances as a metal removal method, partly because of technological developments and partly because more production men have learned to apply it.

Power-tilting spindles for rotary surface grinders—together with improved wheel bonding, higher horsepower spindle motors, high machine rigidity, and continuous downfeed—present a package that combines grinding's inherent accuracy with sizable production capacity.

The quick-tilt spindle development permits optimum stock removal characteristics to be combined with outstanding accuracies and finishes. A 50 per cent production improvement can be attained on average grinding jobs just by tilting the spindle 0.010 in. for the roughing pass, then returning the spindle perpendicular to the work for a fast finish grind before sparking out. Tilting and resetting are handled quickly by pushbutton actuation at the pendant control station.

The contact area between the wheel segments and the workpiece is reduced by tilting the spindle. Because all the horsepower is applied to this reduced contact area, grain penetration and chip size are increased. To keep the wheel self-dressing, high downfeeds are used. The completed workpiece is dead flat and has a perfect crosshatch. Best of all, the cost is lower than that formerly paid for either stock removal or finishing.

Abrasive belt grinding is another area where we have recorded considerable progress recently. Single-pass grinding, size control, higher belt speeds, longer belts providing greater cooling, and new roll designs permit outstanding finishes on work ranging from small flat parts to stainless steel sheets.

Look for Standards in Specs On New Machine Tool Orders

—H. C. DAUM

• A significant stimulus to continuing prosperous business activity for an extended period is the trend in industry to introduce new products and new model changes on an accelerated basis. Recurring changes in materials, processes, and products are a challenge to inflexible manufacturing facilities. To meet this challenge, increased flexibility must be provided by the machine tool and equipment industries to reduce the time needed to get into production.

A trend to flexible facility complements is the development of industry-wide standards for special production machine tools.

During the early part of this year, the automotive industry and other users of production type machines will propose that the mounting and attaching surfaces, location methods, and bolting patterns of certain components and units be standardized to permit interchangeability among various types of production machine tools. This proposal includes standards for special in-line transfer-type machines, special rotary index or dial-type machines, and special way-type horizontal and vertical machines. The standards contained in the users' proposal

(*Please turn to Page* 302)

The adjusting knob on this new adjustable razor is but one of its several precision components made by The Gillette Safety Razor Company on 9/16" Acme-Gridley six spindle bar automatics. The requirements were extremely exacting, *with as many operations as possible performed in the primary setup!*

For example: nine positions are stenciled on a turned portion of the O. D. with interrupted knurling held in exact peripheral location to the marking. In addition, close tolerance hole sizes are involved and *all* external burrs completely removed. All tools had to be synchronized to produce the exacting number-knurl relationship on the periphery.

Working in close cooperation with Gillette engineers, National Acme specialists took full advantage of the wide-open tooling zone, independently operated tool slides and the extreme accuracy and flexibility of direct camming . . . to perform an ingenious job of tooling. Many operations normally considered "secondary" were accomplished in the primary setup. Costly rehandling and "second machine investments" were reduced.

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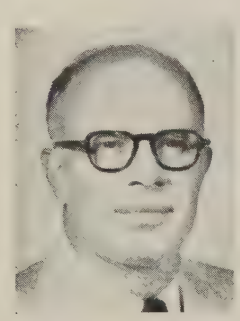

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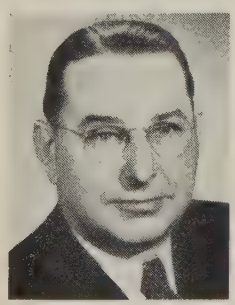

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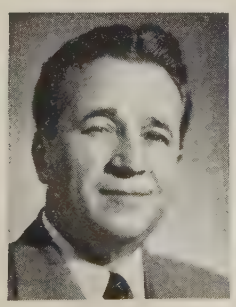

WALTER S. PRAEG
President
National Broach & Machine Co.
Detroit

probably will be specified on new procurement during 1959.

Another step in standardization will be the development of standard mounting surfaces and location methods for so-called standard machines to permit the interchange of jigs and fixtures between like machines of different manufacture.

Machine Controls Boost Short Lot Efficiency

—GEORGE H. JOHNSON

• Continued development and increased application of recorded-information controls will lead the trend toward more automatic and easier-to-operate machine tools. The possibilities of cost reduction in small lot production, via the elimination of special tooling and templates, reduction in setup time, and lowered scrap loss, are definitely appealing.

But numerical control of some machines may not meet the claims made. When all factors are considered, small lot production costs of turret lathe work, for example, can be considerably less with present methods than with a complicated tape controlled machine. Automatic turret lathe operation from recorded data without an operator, setup man, or technician in the picture is still not feasible. Someone must set the tools, check the controls, observe the results, and make periodic adjustments. Preparation of the necessary information and its recording in proper form require valuable time of specially trained people.

Improved controls on automatic turret lathes permit setting up a complete automatic cycle by merely positioning a set of toggle switches and setting a few potentiometer knobs. In many cases, a setup can be made in little more time than would be required on a tape controlled machine, and the setup man does not need to be an electronic engineer.

Better Tooling Needed For Present Equipment

—J. F. ALLEN

• The manufacturing division of any company must concern itself with but one objective: To attain the optimum balance between the material, labor, and overhead costs that go into its product.

In prosperous years, the modernization of plant operations is not particularly difficult. But last year we saw the postponement of many such programs because of the lack of capital.

As a result, attention is being focused on better tooling for present equipment. A few thousand dollars spent on special tooling, such as air operated indexing fixtures or cam operated slide tools, can put new and amazing capabilities into a machine tool which might otherwise be considered obsolete.

New products always present new problems. For example, consider the problem of forming and machining a large and relatively flimsy rocket motor casing to which various pieces of missile hardware must be mated and where tolerances representing less than 1/100 of 1 per cent of basic dimensions must often be held. Roundness and size requirements can be met with explosive forming, which virtually eliminates the problem of springback. Heavy steady rest rings can be mounted on the part (without introducing distortion) with a low melting point alloy.

After they have served the purpose, they can be removed in a bath of hot water which melts the bonding alloy.

Automation Aims At Flexibility

—RALPH E. CROSS

• Greater flexibility and higher operating efficiencies continue to be our goals for the immediate future.

We are now providing our customer with automated machines that will process a complete product line of parts with all the variables. For example, we recently installed a group of transfer machines for processing a new line of aluminum transmission cases. Four different cases move through the different machines as schedules dictate. Standby tools are provided to handle the part variations and are automatically brought into operation as required.

Depending on the work, parts bypass some stations and pick up others. The end result is maximum flexibility for a given product mix, minimum investment of work in process, minimum floor space, and minimum capital investment.

Last year, we introduced a new electronic device which automatically stops a machine if a tool is broken. It reduces downtime and salvage operations by eliminating the production of needless scrap parts due to broken tools.

Gear Tooth Broaching To Make Further Strides During Year

—WALTER S. PRAEG

• New developments in broaching are pointing the way to further cost reduction possibilities for metalworking plants. The new external helical gear broaching process, in which gear teeth are produced by twisting a gear blank while it is being pushed through a hollow broach on a simple vertical hydraulic press, is being applied successfully on cast iron gears. The process is fast, extremely accurate, and produces teeth of excellent surface finish.

Another significant development in broaching, which will be announced dur-

Sam: this may solve our transmission housing problems. Suggest you investigate. J.K.

PRODUCTION MACHINERY

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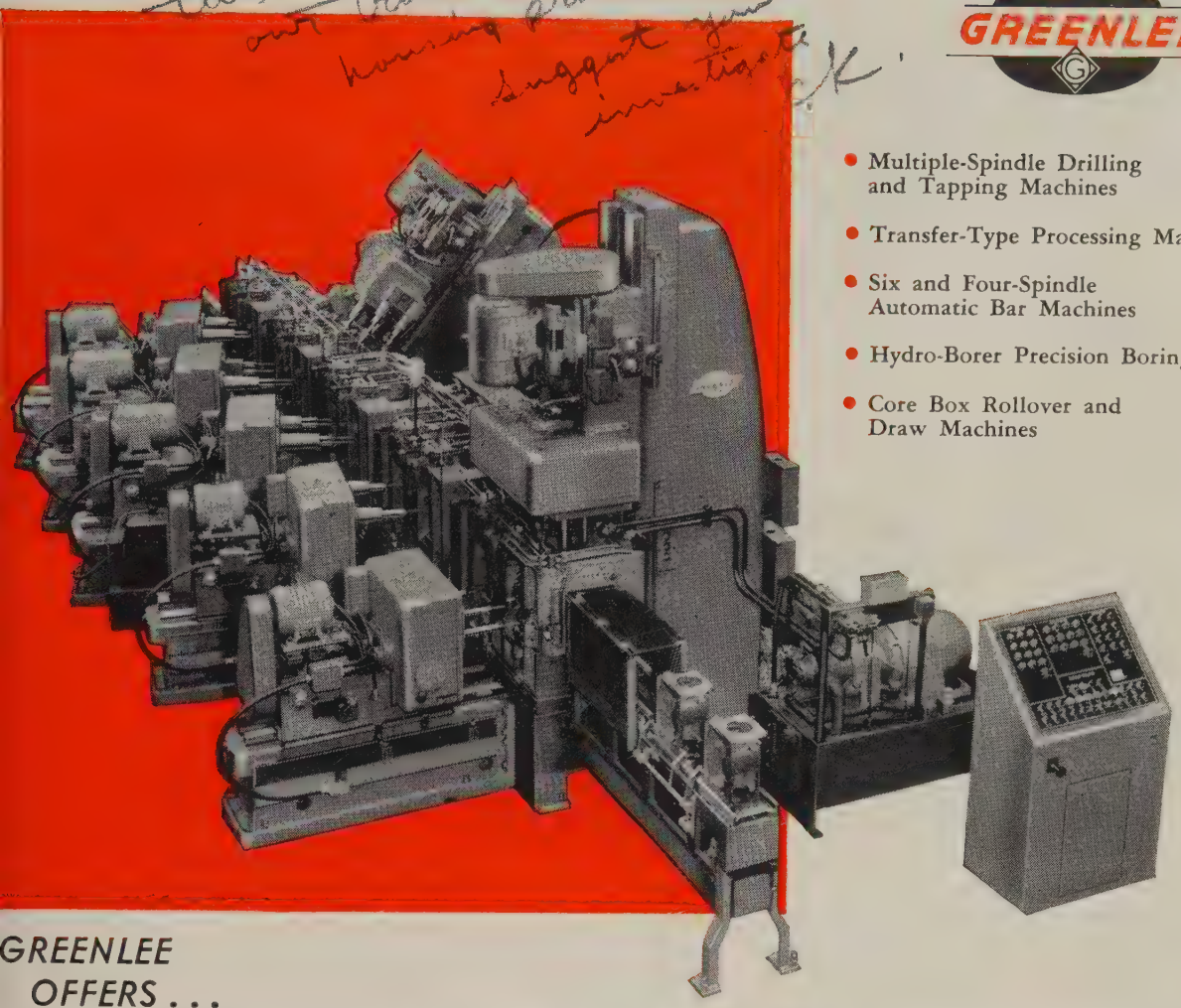

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Joe: these people have a lot of machines in Detroit. Look them over and let me have your reaction — Sam

Machining

EVERETT M. HICKS
Vice President
Norton Co.
Worcester, Mass.

ing 1959, is a method of producing precision internal involute running gears and splines by a single operation utilizing a combination roughing and finishing broach. The finishing portion, which will outlast several roughing sections, utilizes a concept called full-form finishing. This concept, in its first application, has produced internal helical gears of excellent finish and accuracy and can be expected to find wide application for two reasons: 1. Cost savings from the elimination of the separate finish broaching operation. 2. The economy offered by a finishing section that can be used on successive broaches as the roughing portions wear out.

Gear tooth honing will enter its third year of application in 1959. Each year has seen this hard gear finishing process expand its acceptance by industry as an economical method to remove nicks and burrs from gear teeth and to provide sound level improvements resulting from minor corrections in tooth form and surface finish.

Automation May Require, Basically New Machines

—EVERETT M. HICKS

• Automation is maturing rapidly. We believe it will come of age in the sixties. Development of equipment to provide automatic operation at reasonable cost continues to be one of the greatest challenges the machine tool builder has faced.

Many existing machine tool designs have incorporated more automatic features. They have simply been added, one after another, to a machine which was designed originally to be hand loaded and hand operated. The advent of fully automatic operation may require an entirely new basic design, planned to accommodate

(*Please turn to Page* 308)

PRODUCTION EQUIPMENT

APERS

nd helical gears

6A-TYPE	No. 12	36-TYPE	120-INCH
	12″	36″	120″
spur, 5/7 hel.	3/4 spur, 5/7 hel.	3 spur, 4/5 hel.	2 spur, 4 hel.
ext., 3″ int.	4″	6″	8″
	550	300	148

Also available: No. 10 Rotary Gear Shaper—10-spindle machine for very high production rates. Max. P.D. 12″. Max. D.P. 3/4 spur, 5/7 helical. Max. face width 3″. Max. cutting speed 500 strokes per minute.

GEAR HOBBER

NO. 12GH2 HELIGUIDE

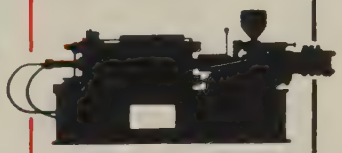
Spur and helical, max. O.D. 12″. Max. face width, spur, 6″; helical, depends on helix angle and diameter. Max. diametral pitch 4. Hob speeds 123 to 430 R.P.M.

FELLOWS injection molding equipment

Fellows Plastics Injection Molding Presses are the fastest fully-automatic machines in their capacity ranges. Sensitive, accurate, built-in controls assure fast, reject-free production with minimum operator attention.

Model 3-125

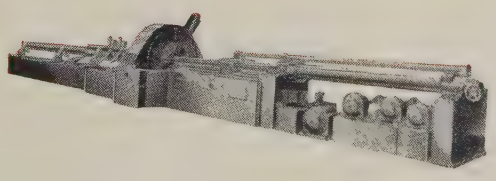
Model 6-200



Model 12-350

	Model 3-125	Model 6-200	Model 12-350
Capacity	3 to 4-1/2 oz.	6 to 9 oz.	12 to 20 oz.
Pounds per hour	45	75	150
Cycles per hr. (dry run)	600 to 840	490 to 650	600 to 800
Max. mold size	12″ x 17″	15″ x 21″	20″ x 33″

No. 4 FELLOWS COLD-FORMING MACHINE



Cold-works metal, ferrous or non-ferrous, to desired shape by kneading or plasticizing at room temperature. External shape is tubular, internal shape is determined by a mandrel. Maximum diameter of finished work: up to 4″ O.D., depending on wall thickness. Maximum length of finished work: 20′.

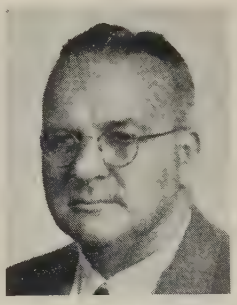
Fellows also builds special-purpose machines for production of gears and other related items. Descriptive literature, technical data and price information on all types of equipment shown is available on request. Contact any Fellows office.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 1048 North Woodward Ave., Royal Oak, Mich.
150 West Pleasant Ave., Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Ave., Los Angeles 45

THE PRECISION LINE

Fellows *Gear Production Equipment*

Machining



E. H. H. GRAF
Vice President, Sales
Detroit Broach & Machine Co.
Rochester, Mich.

these automatic controls and work handling.

The continuing rise in wage rates will inevitably bring pressure to hold costs down by eliminating labor wherever possible. This means the sale of fully automatic equipment will continue to increase.

There is a need for the development of more reliable electronic systems which will allow the advanced developments in aircraft, missiles, and computer production to be applied to machine tools. Electronic systems have the great advantage of flexibility, but the original investment, the maintenance problem, and performance stability are limiting factors in their use in machine tools. We have seen some progress recently through the use of transistors and magnetic circuit devices.

Builder Success Linked To Trained Manpower

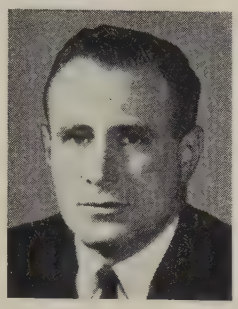
—E. H. H. GRAF

• The entire tone of the machine tool industry is changing. The single great factor which will determine the success of machine tool companies is their ability to produce a suitable number of experienced men. They must have the technical and practical experience necessary to work with ideas brought about by the rapidly changing demands of industry.

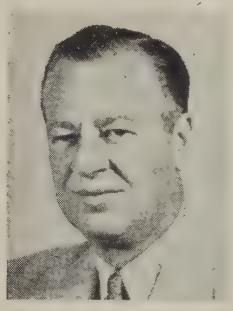
The companies with such men will succeed, and those without them will be unable to compete. I think the need for such personnel in the industry is increasing far out of proportion to the industry's ability to supply it.

We cannot avoid noting the weakness in certain age groups in the mechanical end of business. Further, as the complexion of our business changes and as new

Machining



HENRY D. SHARPE JR.
President
Brown & Sharpe Mfg. Co.
Providence, R. I.



N. M. FORSYTHE
President
National Automatic Tool Co. Inc.
Richmond, Ind.

materials are adopted by industry, we no longer are permitted the luxury of knowing only our own line well. We now must know the other fellow's type of machining as well as our own.

New Machine Designs Aim at Versatility

—HENRY D. SHARPE JR.

• In our opinion, a major design objective in 1959 will be the development of more versatile machine tools.

Customers have liked the cost reductions made possible through the use of special machine tools but have disliked their inflexibility. They have made good use of standard machine tools which are well equipped with jigs or fixtures but have been disturbed by the cost of design changes necessitated by such tooling.

New, more versatile machine tools can offer the same fast production and yet be capable of doing a variety of jobs at no further investment.

Still More Dramatic Machine Tool Developments To Come

—N. M. FORSYTHE

• This looks like the year in which tape control will get a solid foothold.

Prototype machines, controlled by tape and punchcard, have appeared in many places. Our customers are asking about

(*Please turn to Page* 314)

Howard Beacham tripled wheel life,

Howard Beacham has been a Bay State Abrasive Engineer for fifteen years and his total experience is double that. He's worked on grinding problems that have involved every type of metal in jobs as tiny as miniature bearings and as big as the world's largest air compressors and steam turbines.

cut dressing frequency in half at New Process Gear

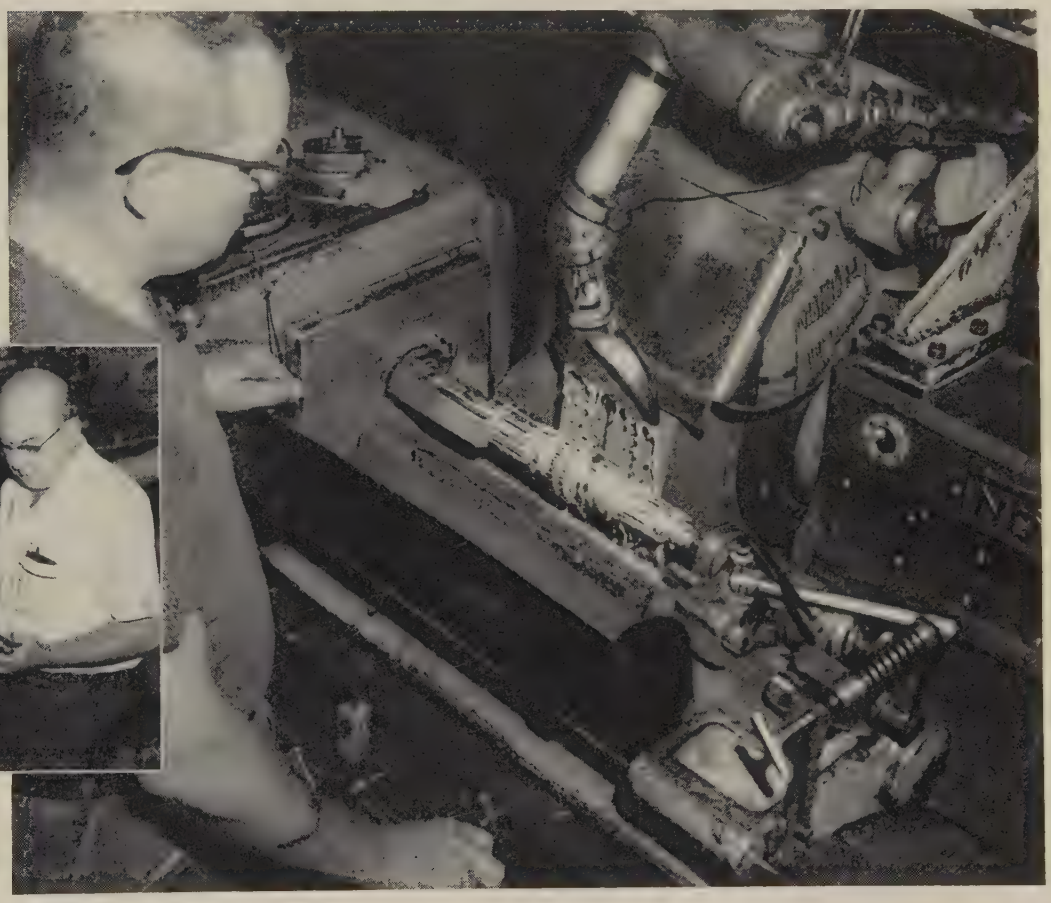
The closer you get to automation, the more it hurts to have production interrupted. That was the principal problem at Chrysler's New Process Gear Division where semi-automatic grinding of flats on truck transmission shafts was halted by wheel dressings every eleven pieces.

The three competitive wheels used in this simultaneous "cam grinding" operation wore down so fast they had to be replaced every week. And, on top of that, an alarming number of shafts were being cracked during the grinding operation.

Bay State's Howard Beacham was called in on the job. He specified a trio of Bay State wheels that produced really spectacular results.

Production jumped to twenty-five perfect shafts per dressing and wheel life went up to three full weeks. Finish was excellent, too.

Why not talk to your own Bay State representative next time you have a grinding problem? Like Howard Beacham he's a trained specialist. *Better grinding at lower cost . . . that is his business.*



Operator Henry Kotas runs grinder equipped with one 24 x 1-21/32 x 12 and two 24 x 1-3/4 x 12 Bay State wheels. The three wheels simultaneously grind flats on main shaft for 5-speed truck transmission.

(*Above*) Manufacturing Engineer Wiley Bell and Plant Superintendent Nelson Fisk examine finished truck transmission shaft.

BAY STATE WHEELS of PROGRESS

BAY STATE ABRASIVES

Bay State Abrasive Products Co., Westboro, Massachusetts.
In Canada: Bay State Abrasive Products Co., (Canada) Ltd., Brantford, Ontario.
Branch Offices: Bristol, Conn., Chicago, Cleveland, Detroit, Pittsburgh. *Distributors:* All principal cities.

Machining

JOSEPH H. BUHR
President
Buhr Machine Tool Co.
Ann Arbor, Mich.

applications and conversion possibilities. Potential users are accepting the idea that blueprints can be converted into coded instructions which a properly equipped machine can read and execute with superior speed and accuracy.

This rejuvenation of multipurpose tooling through numerical control comes none too soon; the days of single-purpose tools are numbered. Automobiles and appliances go out of fashion overnight, and we can no longer afford to make tools which become obsolete with the model change. So, we are starting to build single-purpose tools made of units which can be taken apart and reassembled at will into machines as new as the product they make.

Beyond numerical control and modular machine construction, we can get a glimpse of still more dramatic tool developments. We are on the threshold of machining with "superforces"—explosive speeds and feeds. Explosive metal forming is already a commercial wonder. In another five years—maybe less—explosion and detonation will be harnessed to machine metal as well.

Over-all Productivity Is Design Target

—JOSEPH H. BUHR

• During the next few years, major attention in manufacturing will be given to increasing over-all productivity. Productivity as a whole cannot be increased without improving productivity all along the line: Direct labor, indirect labor, supervisory, service and office operations; engineering; and distribution.

Machine tool producers will be expected to contribute in an important way to improving productivity in manufacturing. Several trends have already be-

(*Please turn to Page* 319)

Machining

DON S. CONNOR
President
Micromatic Hone Corp.
Detroit

come apparent. Among the most important are: Greater attention of purchasers to the real costs of new machine tools, compared with purchase price, wider use of multioperation machines, increased stress on the convertibility of machines to extend their life beyond the original use at minimum changeover cost, and demand for increased accuracy.

Those factors are interrelated. The trend to wider application of multioperation equipment—both in so-called transfer machines and in single machines of the indexing, shuttling, or trunnion type—has in itself placed added emphasis on convertibility, accuracy, and real cost.

Accuracy in the work the machine turns out is inevitably dependent on the accuracies to which machines are built. Close interchangeability tolerances on machine components are in turn a requisite to facilitate convertibility.

Improved Forming Methods Will Reduce Machining

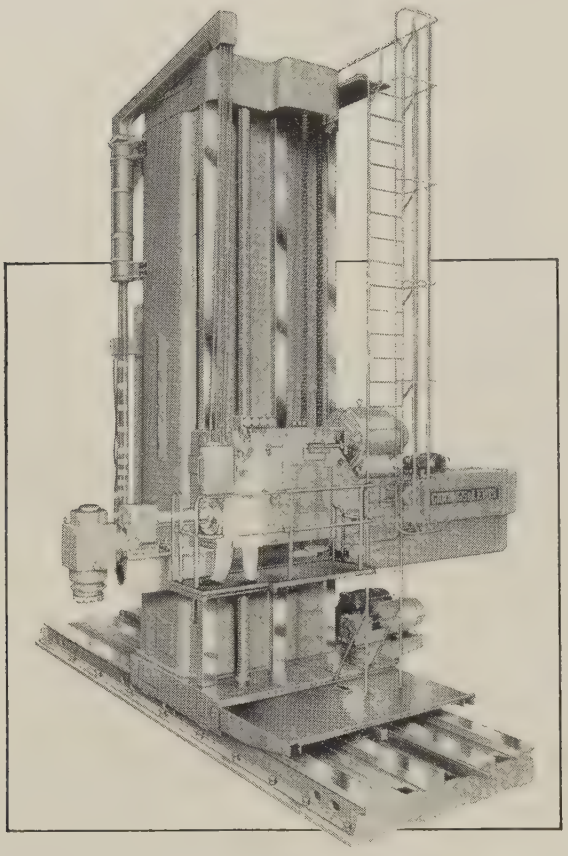
—DON S. CONNOR

• In the next few years, as we enter the "soaring sixties," there will be many revolutionary developments in materials, processes, and products. The developments, and the machine tools that make them possible, are the result of a need for constant improvement in product quality and a reduction in manufacturing costs.

The ultimate in processing would be to form the part to close dimensional tolerances and to generate the desired functional characteristics (in one machining operation) so accurately and consistently that scrap would be practically eliminated. It is in this area that I believe the greatest advances will be made in the next few years. The amount of material cut away in chips will be

(*Please turn to Page* 322)

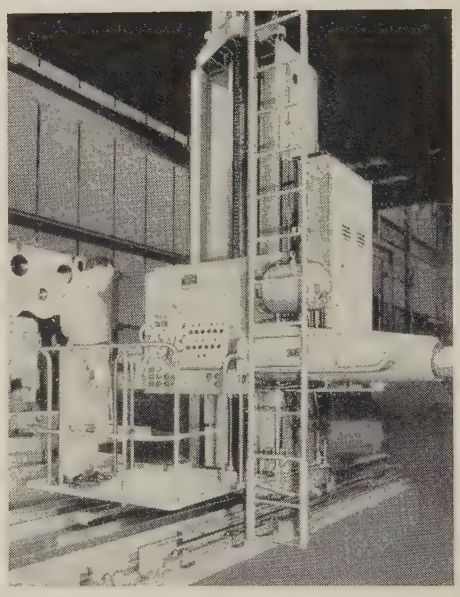
Ideas on tooling for cost reduction



NEW. Designed to reduce the cost of heavy drilling, large-hole boring, and heavy milling on huge workpieces, G&L's new 8″ or 10″ spindle 80 Series machines feature more than 20 feet of vertical headstock travel.

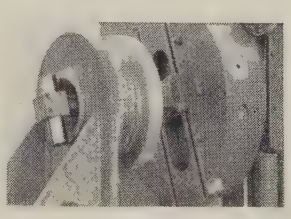
Machines are available with an underarm; cross-sliding column; or a planer-type table.

Giddings & Lewis offers table-, floor-, and planer-type horizontals with spindle diameters ranging from 3″ through 14″ and with electronic controls for template tracing, numerical positioning, or numerical contouring. ASK FOR CATALOG 80-F.



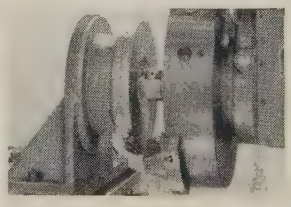
NEW. This tape-controlled automatic horizontal boring, drilling, and milling machine has effected a 30% direct cost reduction in machining printing press parts. Big additional savings come from elimination of jigs and fixtures. The simple, punched paper tape control system repeats with high accuracy. These 4″ or 5″ dia. spindle machines also can be operated by manual pushbutton or digital dial control. A product of G&L's Kaukauna Division. ASK FOR CATALOG H-6.

All these operations,
and more—for faster machining, less handling,
fewer setups, with versatile
G&L horizontal bars



Backfacing with continuous feed facing head.

Turning and boring with continuous feed facing head.



GL-100

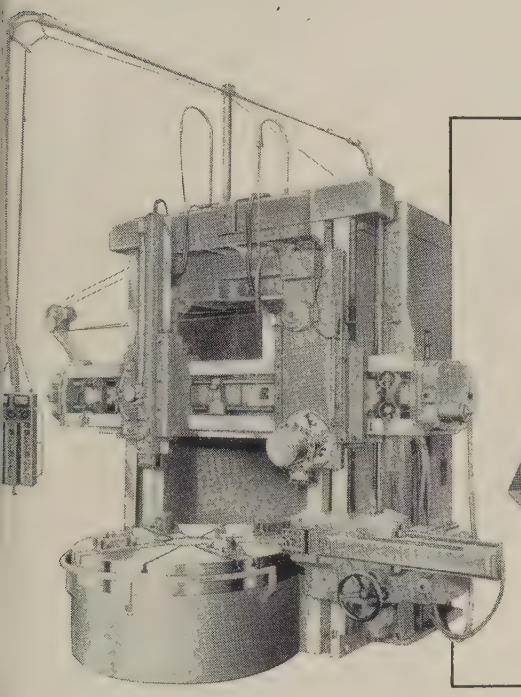
with new multi-purpose Giddings & Lewis machines

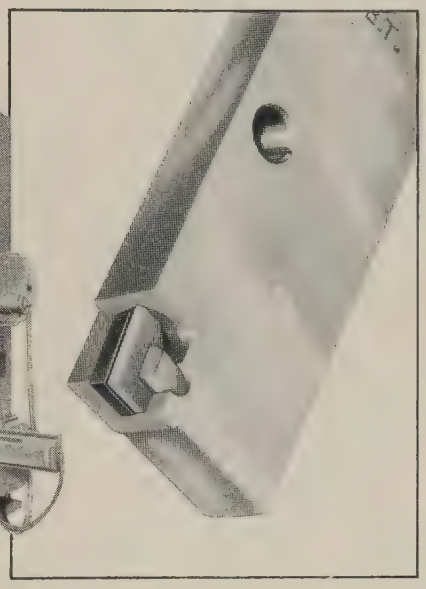
Pictured here are a few of the opportunities for reducing workhandling—for multiple tooling—and for combining on one machine jobs commonly routed to two or more different machines.

Faster and fewer setups—faster machining—fewer nonproductive operations—easier, faster operation—quicker tool changes—and increased machine utilization are among the factors that warrant your full investigation of G&L equipment. Call your G&L distributor, or write.

GIDDINGS & LEWIS

Giddings & Lewis Machine Tool Company, Fond du Lac, Wisconsin

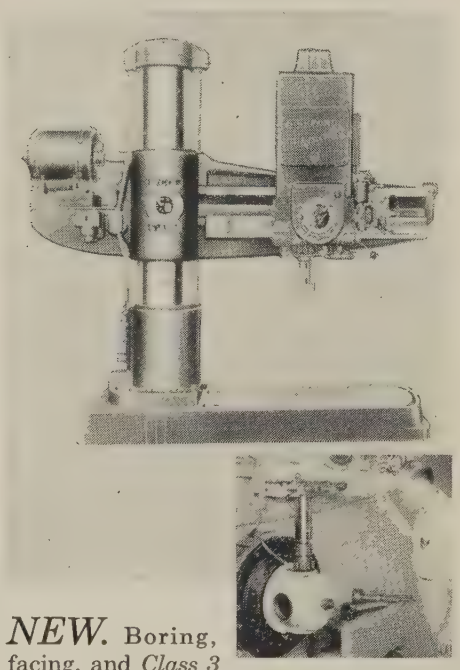




NEW. A vertical boring and turning mill with speed and control that put it out in front for cost reduction. Complete remote control from a pendant station includes preselect of all ram and saddle feeds. Optional constant cutting speed increases tool life, reduces downtime—table speed changes made without stopping or changing gear. Table diameters from 4′ to 14′. Tracer or magnetic tape control available. ASK FOR CATALOG VBM-4.

NEW. With Davis throwaway tip block cutters for your STANDARD Davis block-type bars, tool costs can be reduced and production increased. Here's why: (1) instant tip indexing with minimum downtime; (2) carbide grinding eliminated; (3) low cost per cutting edge—eight edges on negative rake tool, four on positive rake tool; (4) less tool inventory required.

This is a development of G&L's Davis Boring Tool Division. ASK FOR BULLETIN DB-410.

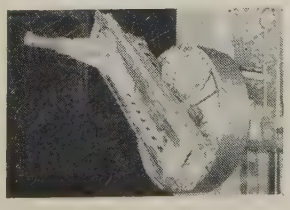


NEW. Boring, facing, and *Class 3 thread tapping* of a 5″ dia. hole in 1½ minutes on the Chipmaster radial—12.5% the previous machining time!

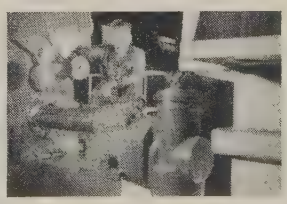
Product of G&L's Cincinnati Bickford Division, the all-new Chipmaster has preloaded bearing spindle to take severe thrust loads of heavy boring, spade drilling, and facing. Instant spindle reversal at speeds to 2300 rpm cuts tapping costs. 4′—13″ to 8′—19″ sizes. ASK FOR CATALOG R-35.

Keyway Cutting with underarm and shaper head.

Boring and Turning Diameters up to 150″ with tool on face plate drive.



Angular Milling attachment mounted on underarm.



Extending Machine Range to save repositioning of work.

Machining

JOHN F. KAHLES
Vice President
Metcut Research Associates Inc.
Cincinnati

greatly reduced. The number of machine tools, conveyors, and operators required will be minimized. Tolerances now only obtained in the toolroom or laboratory will become common production standards.

An example of such processing: The generation of an accurate sphere on the ball stud used in ball joints suspension system. The machining processes have been greatly improved, and costs have been materially lowered.

Bold Research Attack Needed for Machining

—JOHN F. KAHLES

• Many new materials for construction of airpower (and those contemplated for the future) are high temperature, high strength, and ultrahigh temperature alloys. Without exception, these new alloys present difficult machining problems by all conventional methods of metal removal. Such problems are not insurmountable in limited production, but in high production many of the alloys must be regarded as unmachinable at present.

Many producers for aircraft and missiles and Defense Department agencies feel that the tool which will have the greatest impact in solving large production machining of these alloys is research, both theoretical and applied.

Needed: A broad frontal attack on all of the unusual alternate machining methods, such as electrical discharge, Chem-Milling, electro Chem-Milling, high volume grinding, electrolytic grinding, and jet blasts. It appears that even these methods will not be sufficient and that new approaches must be taken.

In the case of high strength alloys, such as steel in the 300,000 psi class, a feasible solution may be found in performing volume metal research in the

(*Please turn to Page* 326)

NEW MARTIN P6M "SEAMASTER" is one of the fastest low-altitude attack aircraft in the air today . . . a 134-foot giant with 4 turbojets that develop more than 600 mph.

Preparing for production, Martin spent 6 months testing tools for drilling epoxy laminated fibreglass printed wire cards.

FINAL CHOICE: MORSE Electrolized Triple Treatment Drills.

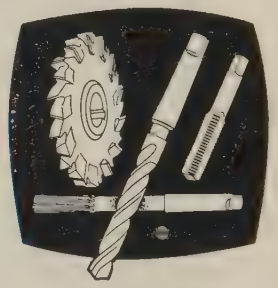
RESULTS: 400% more clean holes, with no tearing of thin copper sections around the holes.
400% fewer drills ground per day.
Less down time, higher production.

And you can get comparable results with Morse Electrolized Tools . . . available *only* from your Morse-Franchised Distributor. *Call him now.*

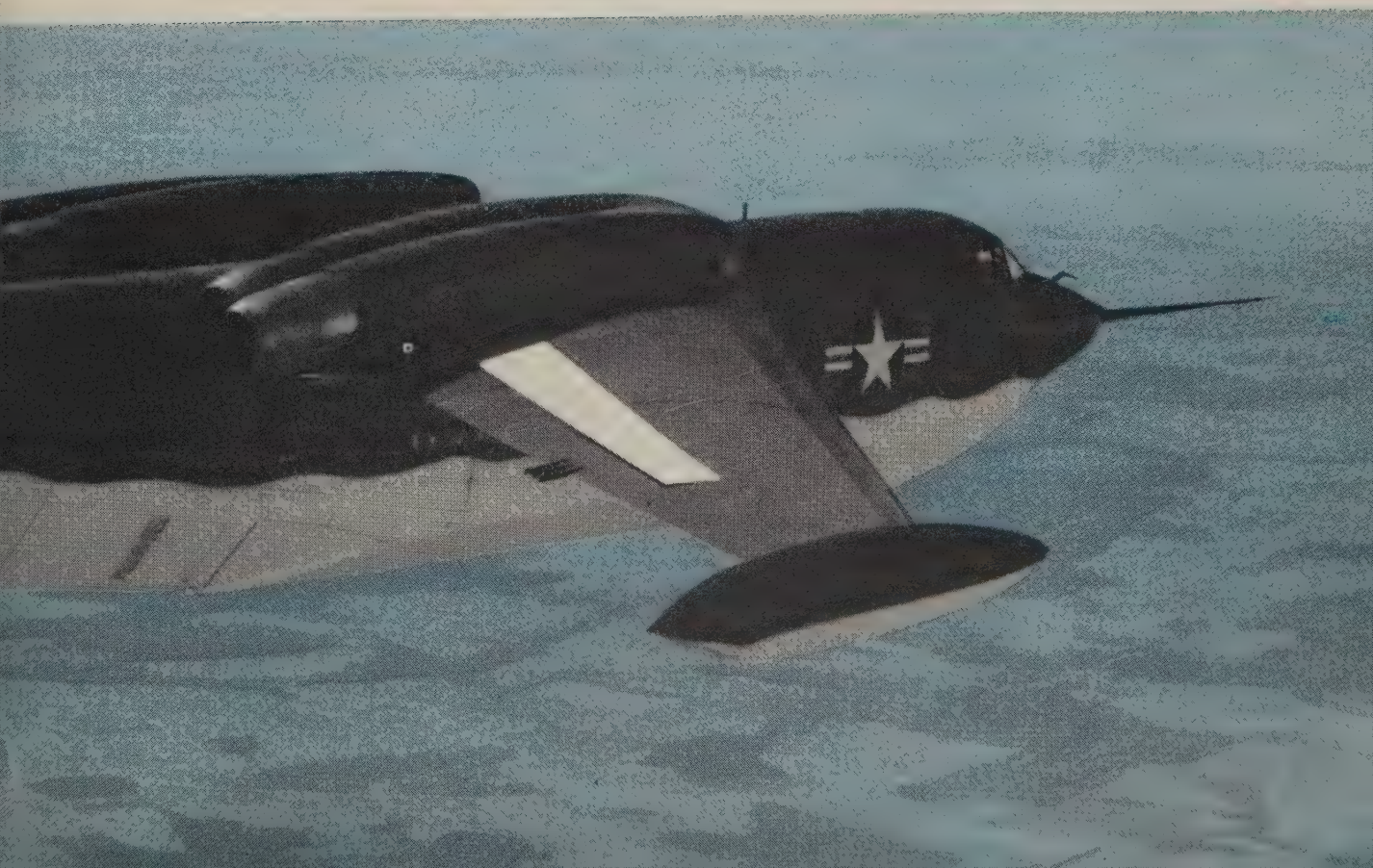
MORSE TWIST DRILL & MACHINE CO., NEW BEDFORD, MASSACHUSETTS
A Division of VAN NORMAN INDUSTRIES, INC.

MORSE

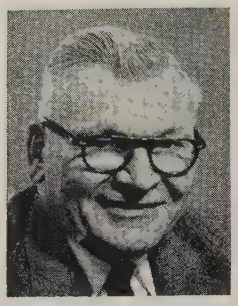
means "THE MOST" in Cutting Tools



WAREHOUSES IN NEW YORK, CHICAGO, DETROIT, DALLAS, SAN FRANCISCO



Machining



RALPH B. BILLINGHAM
Vice President
W. F. & John Barnes Co.
Rockford, Ill.

soft-annealed state. The finishing by grinding could then be accomplished after heat treatment.

Another plausible solution, not too remote, is the development of a new tool material. Ceramics are showing promise but certainly have not arrived. Nonetheless, the direction shown in the ceramic tool field appears sound and might possibly produce the new cutting tool material that is so urgently needed.

New Machines Aimed At Troublefree Operation

—RALPH B. BILLINGHAM

• Automatic processes and automatic machines will be in continued and increased use and demand by all manufacturers. Production with dial type, vertical type, trunnion type, way type and progress through machines is largely controlled by factors like machine maintenance, tool maintenance, part variations, and possible control trouble.

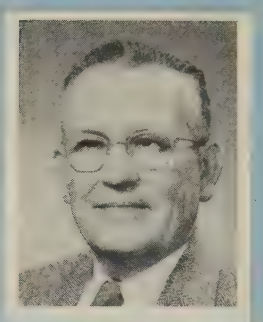
Newer machine designs will reduce trouble from these production controlling factors to a minimum, and some troubles will probably be eliminated completely. Sealed controls and other components will be incorporated in the newer machines, resulting in less trouble. Minor changes in the part sometimes make for much easier machining conditions and a better guarantee of quality. Customers desiring the best production service for their investment should spend more time in studying designs of their parts.

Practical bore finishes, such as honing in one pass with repetitive size control (insuring repetitive dimensional limits and still maintaining the desired microfinish on practically all bored parts) are available and can be established in most production lines.

KENNETH R. BEARDSLEE
General Manager
Metallurgical Products Dept., GE
Detroit

ALLEN SOULER
Automatic Control Engineering
Federal Products Corp.
Providence, R. I.

G. W. HULDRUM
Mgr., Chemical Sales Div.
Shell Chemical Corp.
New York



W. M. WHEILDON
Research & Development Dept.
Norton Co.
Worcester, Mass.

1959 FORUM ON TECHNICAL PROGRESS

Tooling and Gaging

Manmade Diamonds Ready for Exploitation

—KENNETH R. BEARDSLEE

• With the pilot plant phase now behind us and our ability to produce manmade industrial diamonds in volume demonstrated, we firmly believe there will never again be a shortage of diamond abrasive. Industry now has a challenge and opportunity to exploit the cost saving potential of this unlimited supply of diamonds. Sizes are still smaller than we desire, but we are making good progress and soon will be able to fulfill more requirements of industry.

Tooling, generally, is making giant steps. We are working with the cemented oxides and facing exactly the same problems that carbide presented a generation ago. Not only are we going to have to find out about the cemented oxides but we must delve deeper into whether the actual machines we use—or the equipment or the horsepower or the clamping devices—are deficient for the sixties and seventies.

Automatic tooling? How far are we going to go? And along what paths? We must combine the machines, the personnel, the tooling, the resistors and the thermistors, the new metals. We have entered the Age of Space, and it is equally obvious that the standard metals and materials cannot meet the new, the harder standards of heat and stress. Vacuum melting has produced pure metals and alloys hitherto impossible to get. There is no reason to believe that these purer metals cannot in turn be supplanted by other materials not now even commonly used or produced.

So 1959 is really a Threshold Year and not a hallway to the future.

Gages Move to the Machine For Work-Size Control

—ALLEN SOULER

• Look for more applications of gaging at the machine for automatic control of work size. For the most part, applications will involve the in-process gage which measures the work as metal is being removed and automatically retracts the tool when finish size is reached. The other type, the postprocess gage, measures each piece as it is discharged from the machine and, when a size trend is noticed, signals the machine to make corrections so part size is kept within tolerance.

While external and internal grinding operations are particularly suited to automatic control gaging, other operations can employ this method of control (rolling, burnishing, turning, lapping, and drilling, for example).

Machines and measuring systems appear to be adequate. The main problem is the need for additional training on the part of the user to more fully appreciate the factors which can influence high accuracy measurement and to more fully understand these measuring systems when applying them.

Scope of Epoxy Tooling Broadened; Tests Underway

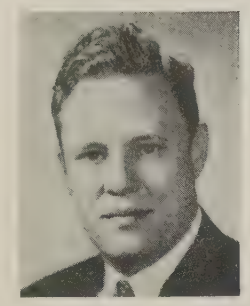
—G. W. HULDRUM

• Still greater advances in epoxy tooling is the bright prospect for 1959. Because of excellent mechanical properties, low shrinkage, and good adhesion to metals, Epon resins have made possible reductions in direct tooling costs as high as 30 per cent and almost 60 per cent in tooling time.

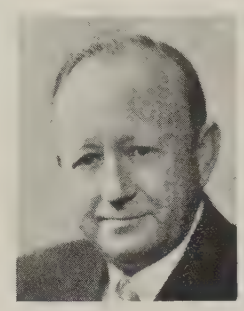
Improved epoxy resin tooling formulations and techniques will further aid design and production engineers in the preparation of master models, patterns, and checking fixtures. Epon resin-wood fiber combinations in conjunction with other fillers and flexibilizers produce more stable master models than those made from mahogany, which is highly susceptible to atmospheric changes.

A new tooling technique, under development, utilizes resistance heating elements and laminated molds in the curing of production parts. This method is much cheaper than making matched metal molds. Elements can consist of

Tooling and Gaging

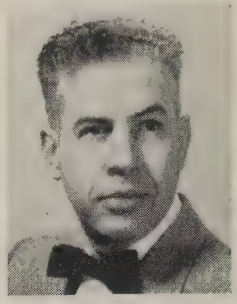


STEWART G. FLETCHER
Vice President, Metallurgy
Latrobe Steel Co.
Latrobe, Pa.



E. C. HUGHES
President
Bay State Abrasive Products Co.
Westboro, Mass.

LOUIS POLK
President
Sheffield Corp.
Dayton, Ohio



H. J. BALES
Chief, Tool Design
Wichita Div., Boeing Airplane Co.
Wichita, Kans.

nichrome wire, conductive glass cloth, or conductive paper.

For the metal forming industry, Shell has under test a new Epon resin which may provide a tooling medium with superior impact resistance and flexibility. This material will fill a basic need for the tooling of drop hammer and draw dies for large volume production.

Look for Ceramic Cutting Tools To Gain in Three Fields

—W. M. WHEILDON

• Three areas of investigation on ceramic tools have been outstandingly successful, and point to expanded employment.

These are: Heavy stock removal machining of high strength steel (such as 4340 at 200,000 psi tensile strength or above); stock removal on cast iron (such as gear blanks and sheaves, for farm machinery); finish machining of high hardness steel (such as bearing races above Rc 55).

Now that performance consistency has reached a more satisfactory level, the single most influential property of ceramic tools is probably their relative resistance to impact. Sufficient data have been assembled to indicate that potential improvement is needed, possible, and can be expected in this area within the next few years.

Also, some information has been generated to indicate that the future may see satisfactory brazing for ceramic tools on jobs where a clamp-type holder is impractical.

Tool Steels Tackle Tough Metal Jobs

—STEWART G. FLETCHER

• The tool steel industry is taking a careful look at the potentialities for vacuum melting. Vacuum melting of aircraft bearing steels and other specialty steels is done on a production basis. Some compositions used for these applications are modifications of regular tool steel grades.

Vacuum melted steels for tooling can be produced in most analyses and are now available in limited quantities both as induction melted and consumable electrode melted products. Advantages over regular air melted tool steels can only be established by performance testing on the job, some of which is now in progress in various industries.

Improvements made in tool materials recently include the free machining tool and die steels, prehardened hot work steels and high vanadium superabrasion resistant steels.

Requirements of the aircraft and missile industries for high strength steels to withstand elevated operating temperatures has promoted new uses for tool steels, notably high speed types for elevated temperature bearings and hot work die steels for supersonic airframe structures.

Grinding Faces New Problems Brought About by New Jobs

—E. C. HUGHES

• Production management is insisting that costs be lowered in grinding and finishing. Parts must be ground faster with closer tolerances and with a greater degree of safety.

New, high temperature resistant superalloys are making demands on the grinding wheel industry. The increased trend toward complete automation presents further grinding problems. The increased use of honing to produce flawless surface finishes is another mounting abrasive problem.

Those challenges are being met by more intensive research and product development.

Some of the latest developments are: New artificial abrasives with improved grinding characteristics; new combinations of abrasives and bonds; grinding wheels capable of greater speeds; successful utilization of manmade diamonds in grinding wheels; reinforcing materials such as nylon, glass, and cotton to withstand the rigors of grinding; intensified effort on quality control throughout the entire manufacturing process; increased use of automatic electronic equipment to assure a more nearly perfect duplication of grinding wheel specifications from order to order.

Equipment on Way for Tape Controlled Gaging

—LOUIS POLK

• Industry's attitude generally indicates a stronger trend toward upgrading metalworking and inspecting.

Scheduled for delivery this year are tape controlled measuring machines, which will focus attention on a system destined to become increasingly important. Positions of gaging styluses and part orientation are controlled by tape information. They produce printed tapes (like cash register receipts) showing size deviation for each dimension or the difference between two dimensions.

Technological progress in automatic gaging and assembly is proceeding rapidly with recent developments covering high-speed pneumatic gage heads that permit inspection rates far faster than present machine cycle times, and smaller air gage spindles.

Electronic gaging is proving highly satisfactory for automatic multiple dimension inspection, especially suitable where data handling such as recording and computing is required.

Aircraft Tooling Progress Demands More Research

—H. J. BALES

• Tooling for sandwich panels is expensive and time consuming. Research toward reducing these costs has not been

(*Please turn to Page* 334)

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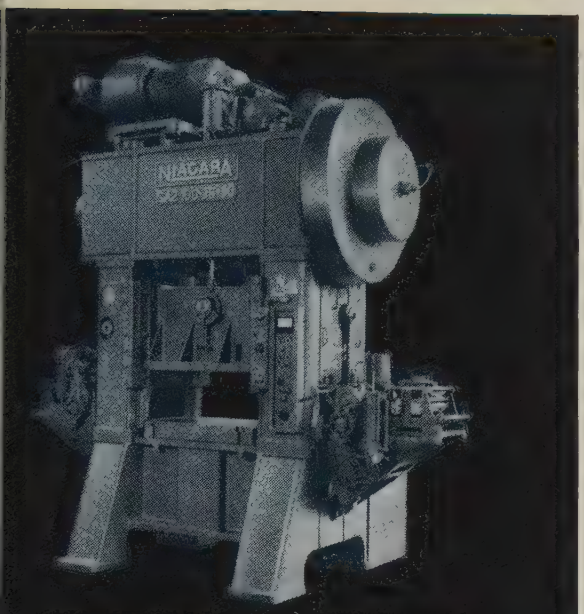

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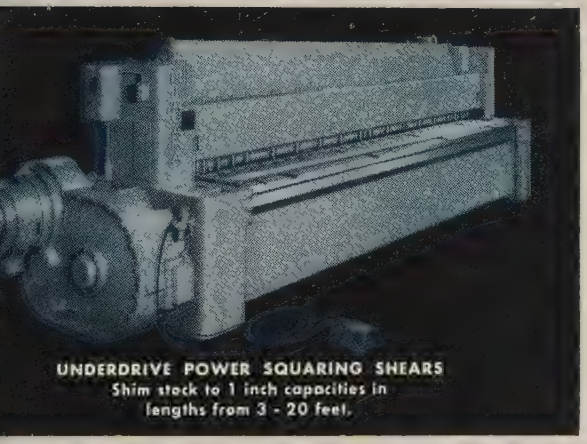

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Tooling and Gaging

PHILIP M. McKENNA
President
Kennametal Inc.
Latrobe, Pa.

EDWARD KIBBITT
Mgr., Stupalox Project, New Prod.
Branch R & D
Carborundum Co.
Latrobe, Pa.

HARRY E. CONRAD
Executive Secretary
American Society of Tool Engineers
Detroit

too fruitful to date. One avenue appears to be the use of numerically-controlled profiling machines for producing contoured sandwich panel tooling. We have been able to establish limited three-dimension computer techniques to permit the preparation of control tapes for three-dimension machining. This breakthrough in programming not only will lower costs, but will also permit tooling to be built to the reduced tolerance requirements necessary for high-performance aircraft.

Every tested means of economical tool fabrication will be needed. It will be necessary to overcome the inertia created by clinging to established techniques, to press for economical tooling production and to develop the tooling needed to overcome the three most difficult areas of high-performance aircraft tooling. These three areas I define as: The joining of sandwich panels by welding or brazing; welding of thin high-strength metal sheets to one another and to structural sections without leaving irregularities detrimental to aerodynamic smoothness; and production machining techniques to permit rapid machining of high-strength steel and alloy forgings, extrusions, and structural sections.

This challenge to tooling will not be overcome this year, but I foresee great progress in this direction by the time another year rolls around.

Carbide Inserts Offer Performance Consistency

—PHILIP M. McKENNA

• I see 1959 as a threshold year to a decade of efficiency in carbide use such as we have never approached in the past.

Application of single use indexable cutting inserts, or throwaways, has had quicker acceptance than any other tooling innovation in history. The uniformity of performance per cutting edge will show as much saving as the direct cost per cutting edge, and freedom from variations due to grinding, brazing, tool geometry, and ground-in chip breakers eliminates much of the tool troubleshooting of the past.

The trend is toward greater automation with self-regulating machine tools. Such systems depend heavily on the uniformly dependable performance of the cutting edges. Tools must not only average a good performance, they must have a high degree of consistency in performance, to be practical where tool changes are on a prescheduled program.

Cutting edges must be supported properly, too, to do a good job. With its 90 million psi modulus of elasticity, tungsten carbide provides such support on bars, quills, and toolholders which must reach into deep recesses of the workpiece. I look for much greater use of carbides in the near future, as a stiff structural material.

Ceramic Cutting Tools Get Ready for Tougher Jobs

—EDWARD KIBBITT

• Significant advances in ceramic tool application on heavy duty and shock cuts were made last year. Satisfactory milling at ½ in. depth of cut on cast iron has been experimentally successful. Several instances were reported of interrupted cutting with ceramic single-point tools on production jobs. This trend should continue into 1959.

Present ceramic research effort is directed toward: Developing more economical methods of manufacturing suitable to ceramics, providing more versatility in manufacturing techniques to provide for larger sections and more intricate shapes, and increasing material strength and toughness where required.

Development engineering now, and for 1959, is directed toward practical ceramic material application on a broader base. Improved geometric designs for ceramic cutting tools are being developed and will be introduced soon. Parts and products subject to wear will have increased attention as it becomes apparent that ceramic materials will improve performance characteristics.

This year will see technical progress take the form of further development and application of the oxides and other ceramic materials, such as nitrides, silicides, borides, and carbides of various elements, for increased resistance to high temperature, thermal shock, shock, erosion, corrosion, wear, or various combinations of these conditions.

We Must Be Ready for Technological Challenges

—HARRY E. CONRAD

• Numerical or tape control, electronic and chemical machining are only a few of the new tools that will be commonplace in the near future. It is well within the realm of probability that even these new processes and methods will be obsolete in their present form within a few short years.

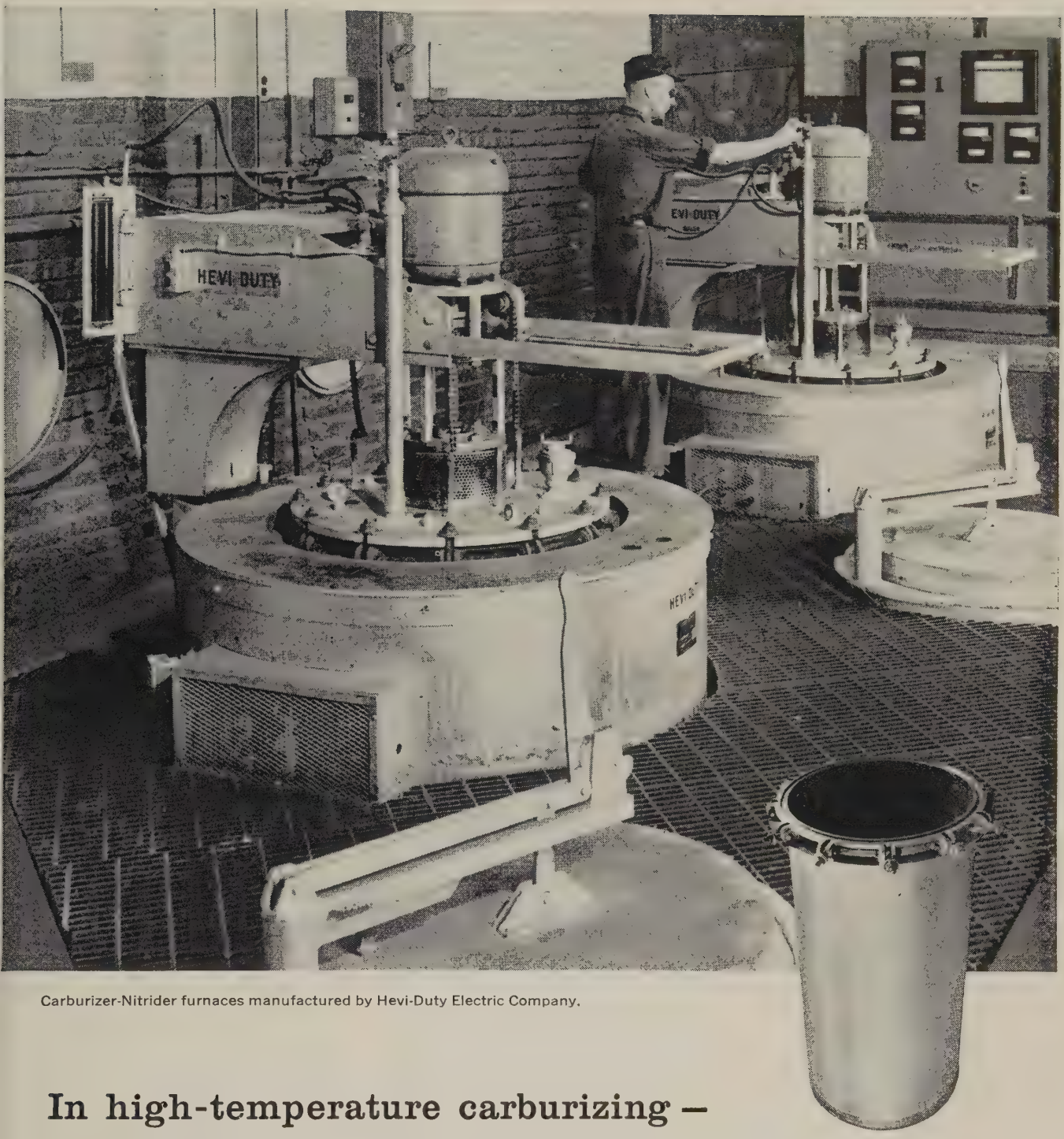
Looking at our industrial growth of the future as it involves the various phases of tool engineering, there are two essential elements dealing with human beings that cannot be overlooked.

One is education and the other sociological.

The rapid rate of inflation is a constant threat. To develop the new capital required to maintain our present standard of living, and increase it, we must raise our rate of productivity.

Educated knowledge will be the weapon of the future tool engineer. The individual must be completely prepared with the necessary knowhow when the challenge presents itself. Full utilization of the time off the job will be essential to keep up to date with technological progress. This applies to both the employed and the student. Further, it is conceivable that industry itself will have to recognize the need and participate directly by providing highly specialized within-plant educational facilities.

Diversification and decentralization of



Carburizer-Nitrider furnaces manufactured by Hevi-Duty Electric Company.

In high-temperature carburizing – Thermalloy* centrifugally cast retorts last longer!

The special requirements of the new high-temperature carburizing process demand retorts of superior heat-resisting qualities . . . qualities inherent in Thermalloy centrifugally cast alloys.

"The greater density of centrifugally cast alloy retorts provides superior strength at high temperatures, thus increasing the anticipated life of the retort when used for high-temperature carburizing," says Arthur Frank, V. P., Engineering, at Hevi-Duty Electric Company. Hevi-Duty is a leading maker of electric heat-treating furnaces and a pioneer in high-temperature carburizing.

If you are using or intend to use the new process, be sure your retorts will stand up. Use Thermalloy centrifugally cast, heat-resistant alloy retorts. *Reg. U. S. Pat. Off.

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Tooling and Gaging

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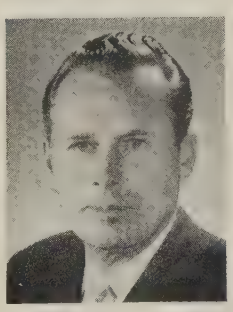
Los Angeles



LEIGHTON A. WILKIE
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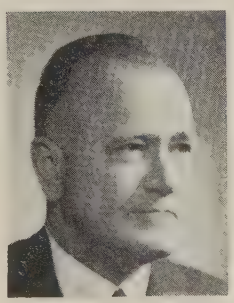
DoAll Co.
Des Plaines, Ill.



FREDERICK S. BLACKALL JR.
President & Treasurer
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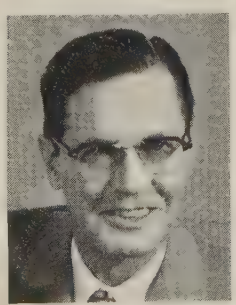


W. B. DUNCAN
Chairman
Wesson Co.
Ferndale, Mich.

manufacturing, coupled with a shorter workweek will create a different way of life for many people. Many things will be affected, creating many problems outside the technological field, but related thereto which will require a keen appreciation of human behavior in the technological decisions that will have to be made.

Plastics Set To Grow as Partner in Metalworking

—JOHN DELMONTE

• Among the significant advances in plastics technology are those fortuitous combinations with metals which lead to superior materials of construction. Steel and aluminum, in both powder and fiber form, are "alloyed" with plastics to yield materials of superior wear resistance, better thermal diffusivity, and better dimensional stability.

Restrictions on casting thickness are being removed and more massive and functional pours are being accomplished. This portends a trend toward cast tools and fixtures of plastics and metal powders as distinct from the fabricating and laminating procedures.

Still in the future are those combinations where metals form the matrix and plastics the energy absorbing means. Ablation has already been considered for rockets and satellites to preserve the functional status of metals. Reduced to industrial concepts, porous metal structures may be impregnated with a plastic material not only for self-lubrication, but also as a means of absorbing heat energy, as an anticorrosive measure, and as a heat sink to counteract extreme low temperatures.

Chipless Forming and Precision Show Promise; New Goals Set

—LEIGHTON A. WILKIE

• Two trends are clearly delineated. Both concern the conservation of vital resources; and they will probably make marked changes in manufacturing methods in the next few years. One is the emphasis on metal shaping or forming with a minimum of wasted material. The other is the tightening up of tolerances so that scrap losses can be reduced and service life of manufactured articles increased.

Although various chipless forming methods are in use and others in development, industry is producing 15 million tons of chips at a cost of over $10 billion a year in the U. S. alone. The enormity of this makes the development of more efficient methods incumbent upon the entire metalworking industry. Fortunately, much is being done.

The second of these trends is also well defined. A program at the National Bureau of Standards is attempting to remove an obstacle to progress. The goal is to reduce the smallest practical measurement limit from two millionths of an inch to one-tenth of a millionth of an inch.

Gaging Trend Is Toward Accuracy, Readability

—FREDERICK S. BLACKALL JR.

• Smaller capsule type pick-up heads for both air and electronic gaging circuits are now being applied to low cost inspection setups on small lot production.

Comparator and measuring type gages, utilizing mechanical, air, or electronic circuits to amplify the measured variation, will probably find increased use in many areas where production quantities are sufficient to warrant their purchase. The trend in all such instruments will be toward greater accuracy and readability. In the case of the electronic amplification circuit, the use of the transistor to replace the vacuum tube will give a more compact unit with less danger of heat generation, due to the low current input. Such units should be less fragile.

Fixed gages will continue to be used widely, especially where the production rate does not justify more rapid mechanized inspection. The technological trend here would be towards gages of greater precision and improved wear life.

Throwaway Carbide Inserts Move to More Jobs

—W. B. DUNCAN

• The most marked trend in metalworking today is the expanding use of throwaway carbide inserts. This applies not only to the single-point tool, where throwaways had their start, but now also to the multiple-point tool field. Reports indicate a particularly strong trend towards use of throwaways in milling cutters, boring tools, and multidiameter, multioperation cutters.

Experience has demonstrated that quite heavy cuts can be taken with multiple-point tools. As a result, throwaway type milling cutters are finding increasing application for both roughing and semi-finishing.

Even more important to industry, however, are the opportunities which throwaways open up through combining of multiple operations in a single tool. Such tools, at one pass, will perform such varied operations as multiple diameter boring plus facing, chamfering, and other operations.

One of the surprises to most companies who go into throwaways—particularly for multiple-point tools—is the

Introducing Allied's

IRILAC™ #1000

New Clear Protective Coating for All Metals . . . as safe and easy to handle as Water!

New method of protection incorporates corrosion inhibitors in a water-soluble polymer base. Dries to an extremely thin, tough, durable coating—clear in color. Does not chemically affect base metal or any post-treatments. Used as a protective treatment alone or to enhance value of post-treatments.

Allied's new Irilac #1000 is a concentrated solution of a water-soluble polymer with built-in complex corrosion inhibiting materials. It was developed to answer the needs of the metalworking industry for a non-conversion process that will provide corrosion resistance and resistance to fingerprinting and abrasion on base metals and electrochemically or chemically finished surfaces—without changing the appearance of the metallic surface.

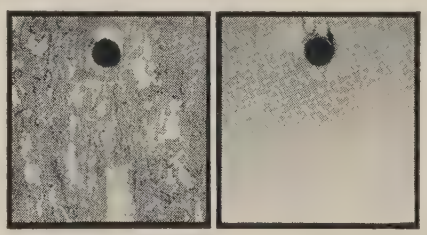
There are no hazards involved—Irilac is non-fuming, non-toxic, and requires no special fire prevention measures.

THE PROCESS

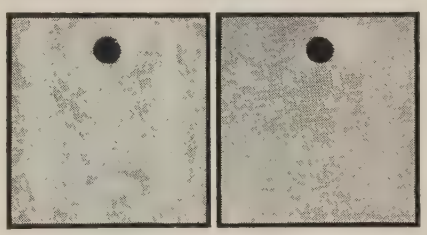
Irilac #1000 is diluted with water to provide a simple one-pass working solution. It is then applied by dip, brush or spray and forms a coating that quickly *bonds* to the metal surface without reacting with the surface.

THE PROPERTIES

The resulting coating is clear, transparent, thin yet durable. It has excellent water-resistant properties, and can be rubbed, handled and subjected to rough treatment. The surface to which Irilac has been applied is not altered—in fact, the transparent coating brings full tone to colored surfaces and clarity to iridescent surfaces. The water-thin physical characteristic of the solution means that the coating provides protection in recessed areas that are difficult, if not impossible, to protect with other methods.



STEEL PANELS: bare (left) and coated with Irilac (right) after 8-hour salt spray.



ALUMINUM PANELS: bare (left) and coated with Irilac (right) after 168-hour salt spray.

WHERE IRILAC CAN BE USED

Irilac #1000 can be applied to *any* metal—wet or dry—treated or untreated. All metals can be processed in *one* operation in the same solution. It can be applied in conjunction with any process—over Iridite, anodized, phosphated surfaces, black oxide, etc. Surfaces treated with Irilac provide a good base for paint.

APPLICATION ADVANTAGES

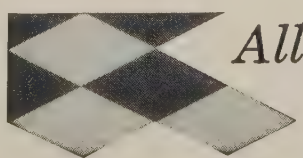
No other process or material available for the protection of metals offers all the application advantages found in new Irilac #1000:

1. It can be applied to *any* clean metal simply by dip, brush or spray. No special equipment is required.
2. Saves time—just apply and dry—no reaction time required.
3. No hazards involved—no exhaust or special fire protection equipment is required. Irilac is non-fuming and non-toxic.
4. Saves space. Presents no disposal problem. Low in first and final costs.

Because of its versatility and complete safety, Irilac has unlimited uses. For example, it will protect aluminum furniture, brass hardware and fixtures, steel parts of all types, zinc castings, etc. In fact, any base metal or plated surface, or those treated with electrolytic or chemical post-treatments, can be improved or enhanced with Irilac.

IRILAC #1000 MAY BE THE ANSWER TO YOUR PROTECTION PROBLEM

Our development staff will be glad to work with you to determine the significant benefits Irilac can offer you. Simply send us some parts and let us show you what Irilac can do. No obligation, of course.



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West Coast Licensee: L. H. Butcher Co.

Tooling and Gaging

HARRY CONN
Chief Engineer
Scully-Jones & Co.
Chicago

striking reduction achieved in tool cost per piece even though the new tools are more complex in nature and higher in initial cost.

Tool Change Time Is Critical Cost Factor

—HARRY CONN

• The direct need in metal machining is to apply economic analysis to operating expenditures in a more thorough and realistic manner than has been done.

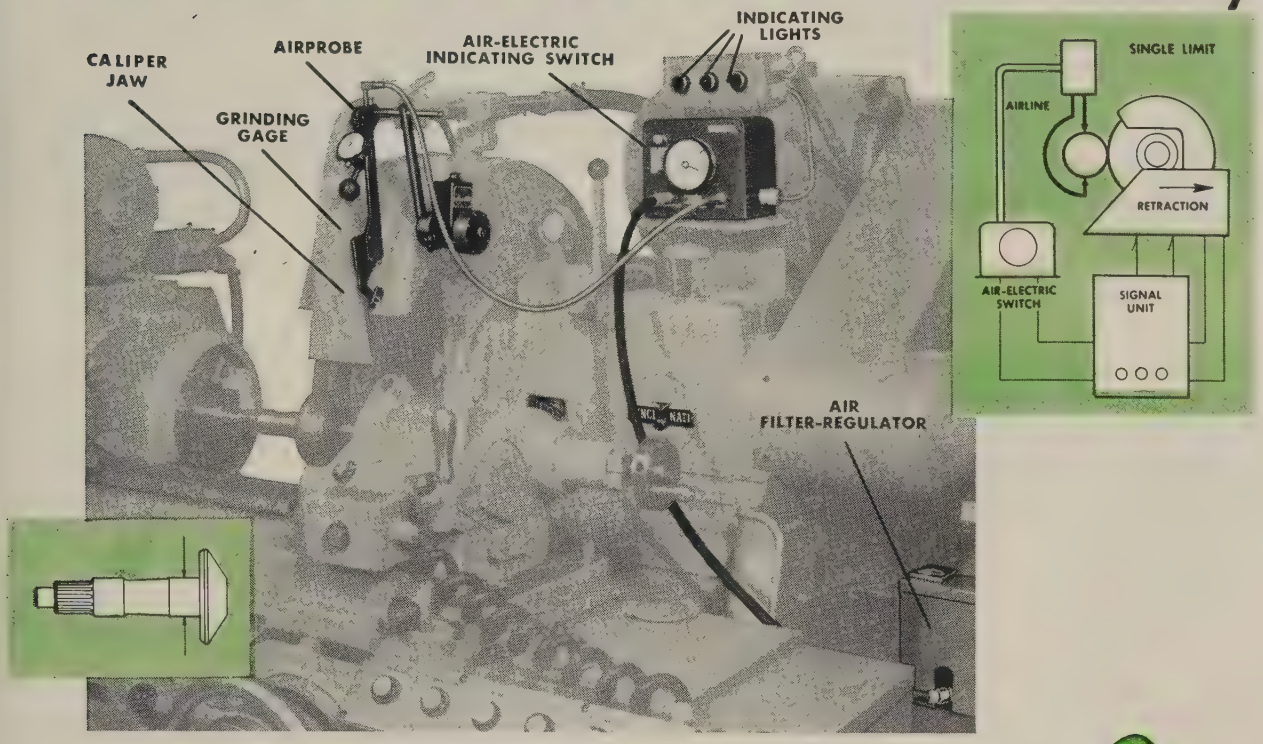
Every time a tool is inserted into a machine, there are at least three costs: Tool changing, tool grinding, and perishable or tool depreciation. The sum of these three is tool replacement cost. The incorrect method of calculating tool replacement cost is frequently the direct reason for lower efficiency of high production equipment.

The universal practice of computing tool changing cost is by multiplying the number of minutes needed to change tools by the cost of direct labor per minute. Tool changing cost should be computed on a basis of minutes needed to change the tool times "what the machine is worth per minute," which is the value of production lost.

If a machine at 80 per cent efficiency turns out 100 crankcases an hour, performs 350 machining operations on each part, and the part is valued at $18 at that stage of production, the production value of the machine is $1800 an hour or $30 a minute. If it takes 2 minutes to change a tool, the real cost of changing tools is $60 of lost production value —not about 10 cents for direct labor.

Not using a realistic approach has resulted in modern machines being equipped with horse-and-buggy design toolholders that multiply the tool changing cost.

MODERNIZE YOUR PLAIN GRINDING . . . *Economically!*



Automatic Control Gaging improves your grinding operation 3 ways . . .

1 It controls on the basis of finish size *only*, thus overcoming the disadvantages of timed cycle or fixed stop grinding. Wheel wear, O.D. variation in work to be ground, "give" in many of the machine elements, and flexing of the work, no longer affect accuracy and piece-to-piece uniformity of the finished part.

2 It controls *automatically*, thus you eliminate any errors caused by operator fatigue, inexperience, or inattention. The Federal automatic control gage never tires, will hold part size to .0001″ or better on a good machine, and is easily adjusted to control different sizes of work. Its air-electric system overlooks minor surface irregularities which confuse size readings of other gages.

3 Automatic control gaging makes it possible for one operator to handle two grinders performing the same or different operations. Here's an actual case history of direct labor cost savings:

	MEN	MACHINES	COST PER PIECE	PRODUCTION RATE pieces per 8 hr. shift
BEFORE	2	2	$.03585	1344
CONTROL GAGING INSTALLED				
AFTER	1	2	$.01526	1386

SAVINGS (per piece) . . . . . $.02059
RATE INCREASE (per shift) 42
TOTAL SAVINGS (per shift) $28.59
EQUIPMENT COST AMORTIZED — 60 DAYS

HOW IT WORKS

The Federal automatic control gage measures the work continuously *as metal is being removed* and automatically retracts the wheel the instant finish size is reached.

EASY TO INSTALL

This standardized Automatic Control Gage (Model 133M-103 illustrated) is stocked for speedy delivery. Only a few components to install. Easily applied to any plain grinder having hydraulic wheel slide. Can also be used in connection with wheel slide stop to *additionally* provide spark out.

Federal control gages are also available through machine tool manufacturers for control of either plain or I.D. grinders and are supplied as part of the grinder package. When discussing machine tool requirements, be sure to specify FEDERAL gaging. Federal maintains close engineering alliance with leading machine tool manufacturers. They, too, will be glad to discuss automatic control gaging with you.

For more information, contact the nearest FEDERAL representative or write . . .

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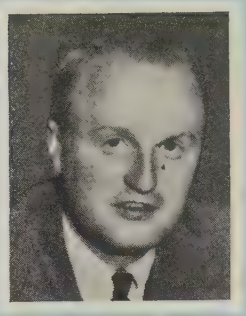


C. H. SMITH JR.
President, Steel Improvement &
Forge Co., Cleveland

PRESTON L. HILL
Colonel, USAF
Chief, Mfg. Methods Div., AMC
Aeronautical
Systems Center, Wright-Patterson
Air Force Base, Ohio

1959 FORUM ON TECHNICAL PROGRESS

Forming

Explosive Forming Can Outmode Several Conventional Methods

—T. E. PIPER

• Within the next five years, powder material parts may replace casting, forging, extruding, and machining. Ductile ceramics may be possible by increasing the velocity and pressure of pressing and extruding.

Supersonic and hypersonic vehicles mean complex parts and within five years, new structural parts capable of resisting 1500° F for prolonged exposure and 2500° F for a few minutes. They must have weight-strength characteristics at operating temperatures far better than present airframe materials used at ordinary temperatures.

High temperature metals (molybdenum, tantalum, columbium, beryllium, ceramics, and cermets) are harder, more brittle, and less ductile than steel. Today's machining practices for such metals are out of the question.

For example, steel forgings by today's standards require 77 per cent reduction in weight by machining. Total cost of the finished part is four times more than that of parts from a light alloy. High-temperature resisting materials would cost many times that amount for identical parts. It's time to get out of the chipmaking business.

High-energy-rate machines, capable of extruding, forging, or forming metal, ceramics, cermets, and powdered metals into precision shapes is a requisite for the Space Age materials. The born-to-shape objective can only be accomplished by working metals at 400 fps and pressures up to 1.5 million psi. Such machines will revolutionize metalworking. High-energy-rate forming is one of the real advances of the last 25 years.

Extrusion of steel by high-energy rates produces parts with improved surface finishes, precision tolerances, reduced web thicknesses, and smaller fillet radiuses. Little die heating was experienced with or without lubrication.

Powder metallurgy, one of the oldest metalworking processes, has never been able to produce 50 lb aircraft parts because no suitable presses were available. We believe high-energy-rate machines will make such parts possible.

The born-to-shape concept should lower costs and increase reliability. The most ideal materials will then be engineered to perform a functional task.

Widespread Use of Explosives To Come by 1965

—VASIL PHILIPCHUK

• Explosives will take on an additional meaning for man. They will be viewed as tools for pressing, cutting, welding, shaping, cold working, sizing, flanging, embossing, bonding, locking, threading, molding, riveting, joggling, and cladding.

By 1965, production of parts, required for daily living and research, will be a fact.

Various industries will operate explosive shops. Such facilities will make parts more economically, or those which are impossible to produce today.

Explosive processes will benefit both large and small firms. They will relieve the need for large expenditures for capital equipment.

Personnel will be trained by those expert in handling explosives or licensed by state authorities.

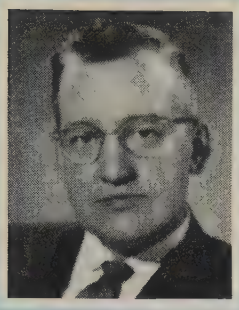
New Techniques Are Needed To Handle Refractory Metals

—C. H. SMITH JR.

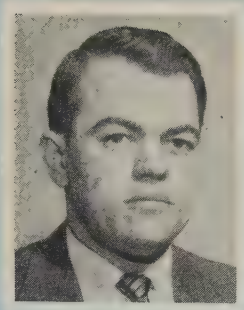
• The next two or three years will see many changes in forging, particularly in components for the aircraft and missile industries.

During the coming year, refractory materials will assume great importance. New techniques must be developed for rapid heating and deformation of such metals. New and radical departures from conventional machining or finishing must be devised. New and better die materials must be developed.

This should be a year for major advances in extrusions. Orifice extrusions



ALBERT J. SARKA
Director of Research & Development
Wean Equipment Corp., Cleveland



RICHARD B. STRIBLEY
Manager, Phosphate Coating Div.
Detrex Chemical Industries Inc.
Detroit

CARTER C. HIGGINS
President, Worcester Pressed
Steel Co., Worcester, Mass.

ALFRED H. PETERSEN
Group Engineer, Producibility Methods
Calif. Div., Lockheed Aircraft Corp.
Burbank, Calif.

have already been well accepted in the nonferrous materials, and we will see orifice, blind, and secondary extrusions used in a wide variety of materials. The trend will be definitely toward less machining, higher material utilization, and retention of forged outer fibers.

Inexpensive protective coatings to prevent decarbonization will find greater use. More precision will be specified in all classes of forgings.

Air Force To Switch Emphasis To Small, Quality Production

—COL. PRESTON L. HILL

• Change is today's most important issue to the Air Force. Its true significance lies in the "thinking process" behind tomorrow's systems.

Today's practices will not solve tomorrow's problems. Radically new, efficient production methods must be brought about.

Tomorrow's weapon systems cannot be built to today's standards or its methods. Advanced aircraft as well as missiles will operate under considerably more severe environmental conditions. Future vehicles may be of structures built from close tolerance products like honeycomb.

While quality must improve, quantity will decrease. Today's tons of forgings, extrusions, sheets, or vehicles will become orders for a few items of unprecedented quality—with definitely shortened lead-time. Everyone must realize that the era of quantity production for the Air Force is rapidly disappearing.

Increased operating temperatures necessitate the use of outstanding refractory metals, as well as tough superalloys.

We must reduce forming costs of such metals. One promising reduction method is explosive shock waves. All that is needed to form a thin sheet is a suitable container (an ice cream container has been used), a transmitting medium like an explosive charge, and some open space. Forging, extrusion, and billet separation look equally attractive.

Says Cost of Materials Will Outshadow Labor Rates

—ALBERT J. SARKA

• We feel that managers will want tomorrow's conventional presses to offer more strokes per minute and more accurate feeds. The cost of material, rather than labor, will be one of the main things to watch.

There is a need for better roll feeds, using the overrunning clutch and brake combination. Their inherent inaccuracies caused by speed and brake temperature changes will encourage a move toward the continuous feed-moving die combination. One evidence of such a trend is the roll forming of tubes in conjunction with a flying cutoff.

Finishing Customer To Value Quality More Than Price

—RICHARD B. STRIBLEY

• New methods, materials, and processes must appear in the near future. For example, new and better paints have appeared faster than the methods and materials for removing them. Inexpensive, inefficient strippers are going to be replaced by those of high quality. The net result is more economy.

Industry must find better handling methods and tighten up on quality controls. Price is important, but quality products are finding more buyers. Suppliers can help meet that demand by improving shipping, storage, and packaging methods.

New testing methods must be developed and standardized throughout industry.

Much work is being done to control rust and corrosion, but much more effort is required before the problem is licked.

List Six Top Developments Slated for Near Future

—CARTER C. HIGGINS

• These are the important developments in the near future:

1. A new method of compounding metal powders, leached from scrap materials, promises better materials for stampers. They can be rolled into solid or coated copper-nickel strip.

2. More progress will be made in ceramic coating of stampings to withstand 3000° F. Parts that used to require heavy sections made of costly materials can be stamped of lighter metals that reduce costs.

3. High energy rate forming is much faster than press forming. Sudden impacts obtained from cartridges and explosive charges offer new shapes in heat treated and otherwise refractory metals. There is no springback, and equipment is simple.

4. A standard glossary of stamping terms is due for completion in 1959.

5. Stampings combined in layers will replace parts made by other methods.

6. Several substantial companies will make rather than buy stampings. If their experience is satisfactory, this could be an important trend.

Hot Airframes Have Helped Progress in Forming

—ALFRED H. PETERSEN

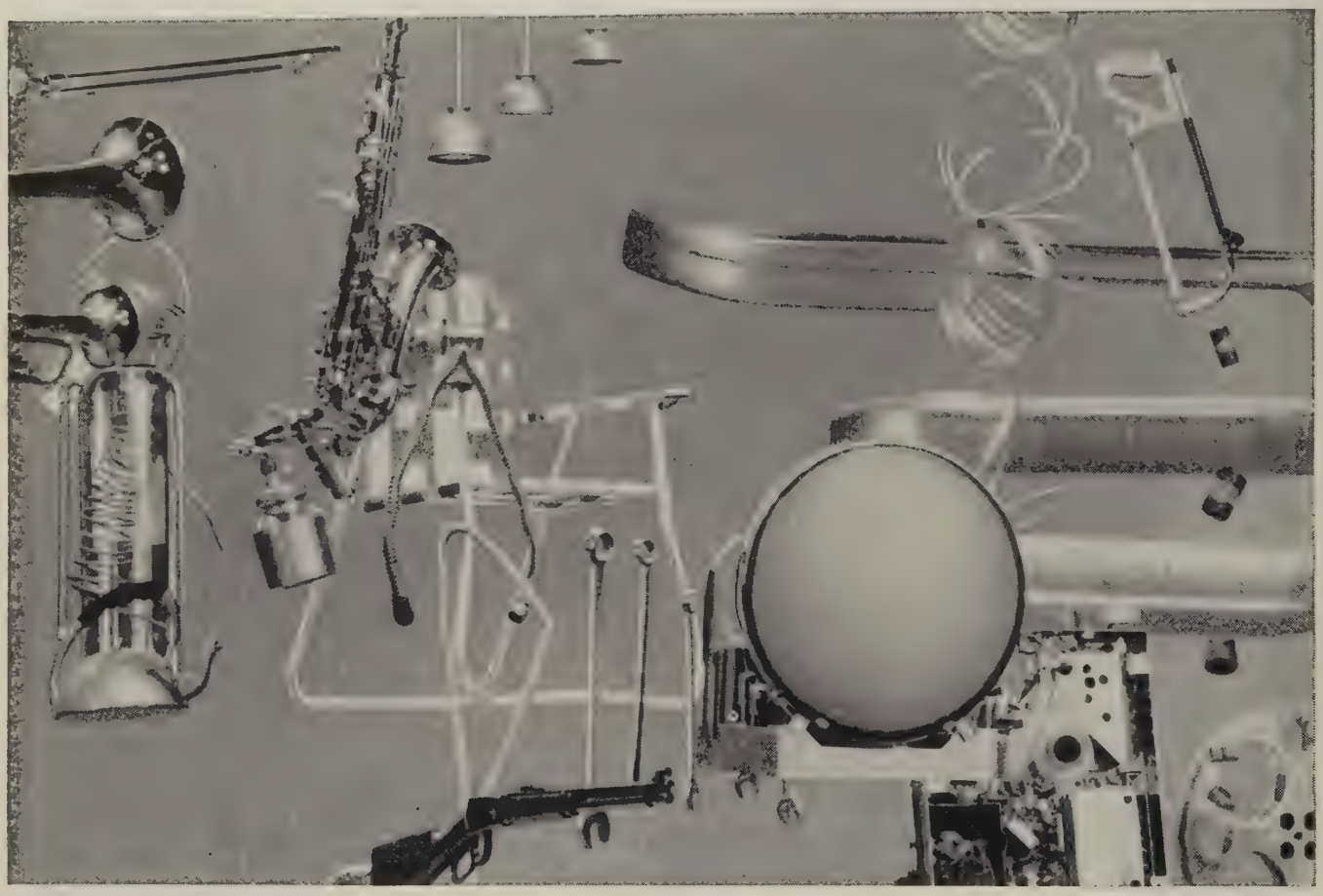
• The emphasis for the next few years is going to continue on the "hot" airframe.

Transports will encounter 700° F, and bombers, interceptors, and missiles will run up to 3500° F.

Beryllium, tungsten, molybdenum, vanadium, chromium, tantalum, and columbium are being worked on to find a way to produce bars, sheets, tubes, and forgings and to reduce objectionable characteristics by alloying. Rapid oxidation,

(*Please turn to Page* 344)

Columbia-Southern Trichlor provides economical, efficient



Degreasing units are available that will clean anything from multi-ton generator stators to tiny watch gears.

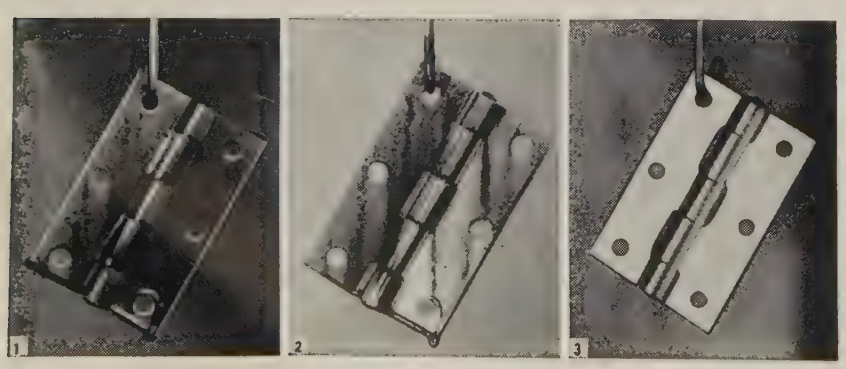
The modern stabilizer in Columbia-Southern Trichlorethylene has aided metal fabricators in eliminating a number of troublesome degreasing problems.

In the past, many plants experienced extreme difficulties, resulting in damage to work or to the degreaser unit. Frequently these difficulties could be traced to use of inadequately stabilized solvents.

Columbia-Southern Trichlor, on the other hand, is formulated to provide a stabilizer that assures built-in chemical protection against breakdown under light, heat, oxygen, acids, moisture and repeated distillations.

Sludge formation is kept to a minimum as this protection extends itself to the oil soils removed in degreasing.

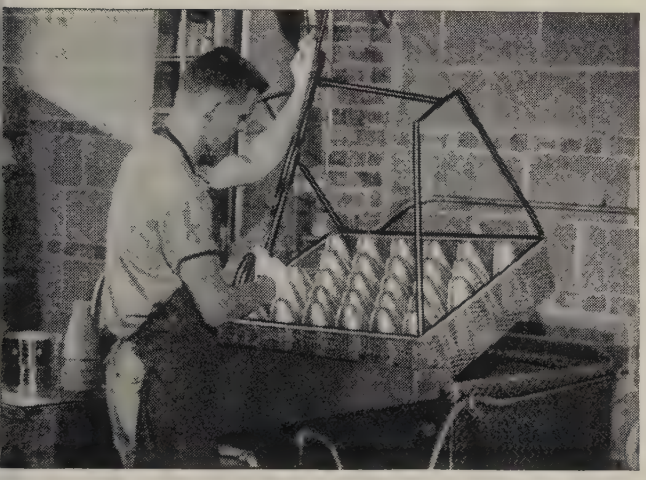
Degreasing action starts as soon as the part is conveyed into the Trichlor vapor. The vapor condenses on the part immediately. The liquid solvent, now laden with the grease it has removed, drips into a boiling sump.



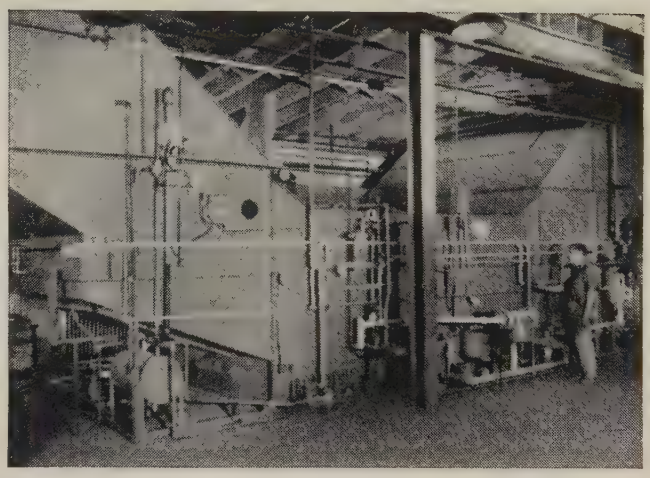
1. A hinge covered with grease, represents a typical metal part, ready for the degreasing process.
2. Vapor action has started—much of the grease has already been dissolved and carried away by the condensed solvent.
3. The process complete—the hinge leaves the vapor degreaser, clean and dry.

with its modern stabilizer

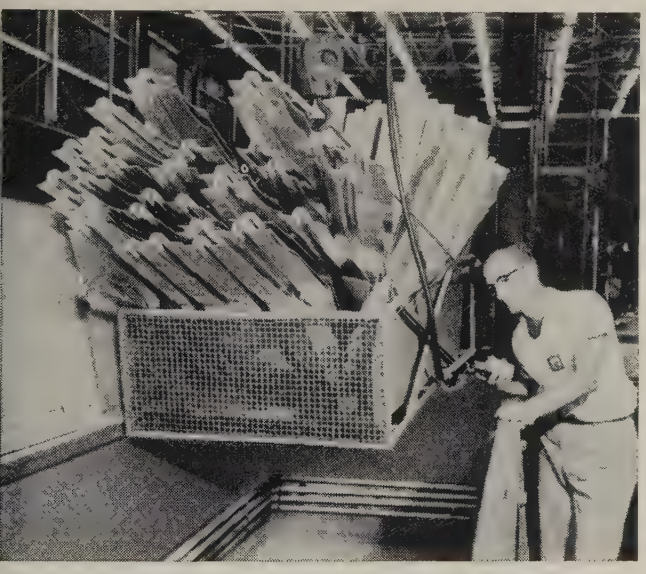
low-cost vapor degreasing



Lamp reflectors are degreased in this manually operated tank type vapor-spray unit. The unit is relatively inexpensive and it occupies very little floor space.



Fully automatic vapor—spray—vapor unit is used by this toy manufacturer for degreasing. Conveyors carry parts through all processing operations.



Vapor degreasing with Columbia-Southern Trichlor offers an extremely flexible and low-cost cleaning method for parts ranging in composition from aluminum to steel, zinc, brass, magnesium, titanium, special alloys.

Aluminum sheet and formed parts are particularly sensitive to improperly stabilized solvent. High-stability Columbia-Southern Trichlor is now specified by many large volume aluminum fabricators for efficient degreasing.

Columbia-Southern Technical Service representatives have earned a top reputation for working with customers in trouble-shooting and in establishing more effective and economical procedures for degreasing. Their services are at your disposal.

Have Columbia-Southern's experts check the efficiency of *your* degreasing operation or help *you* with your solvent specifications. Just contact our Pittsburgh address, or any of the fourteen conveniently located District Sales Offices listed below.

COLUMBIA-SOUTHERN CHEMICAL CORPORATION

A Subsidiary of Pittsburgh Plate Glass Company • One Gateway Center • Pittsburgh 22, Pennsylvania

DISTRICT OFFICES: Cincinnati, Charlotte, Chicago, Cleveland, Boston, New York, St. Louis, Minneapolis, New Orleans, Dallas, Houston, Pittsburgh, Philadelphia, San Francisco IN CANADA: Standard Chemical Limited

Forming

EARLE A. CHANNER
Vice President, H. M. Harper Co.
Morton Grove, Ill.

MELVIN D. VERSON
Vice President, Administration
Verson Allsteel Press Co.
Chicago

C. C. CADITZ
President, Northern Metal
Products Co., Franklin Park, Ill.

J. L. McMARTIN
Director of Engineering
Fenn Mfg. Co., Newington, Conn.

toxicity, lack of ductility, and directional strength must be eliminated.

The steel industry is working out the problems of large, wide, flat, close tolerance sheet alloys that have high strength, high temper, and corrosion resistance. The titanium industry program is slowly raising strength level and reducing the cost.

Refractory metals, ceramics, and cermets are going to find increasing use as heat sinks, leading edges and surfaces, and combustion chamber liners, but it depends on progress in fabrication.

Weight will continue to be an important factor. The current furor over steel and titanium honeycomb is dictated by that problem. As the art improves, joints will become more critical. Large precision extrusions, forgings, pressings, and castings will be developed for lightweight attachments that will require a minimum of machining and joining operations.

Chemical milling is certainly going to increase. Machining speeds must increase. Vibration in a machine tool has to go. Air bearings and other means of reducing friction and conserving power are inevitable. Individual nuclear power drives are certainly a probability.

Numerical controls will be expanded. For airframes, the transition from engineering loft and wind tunnel data to finished parts and components will be accomplished without costly intermediate tools such as loft boards, masters, mockups and fixtures.

High impact energies to form hard materials have distinct advantages. The old bugaboos of warpage and springback can be eliminated. High explosive charges are being regularly used to size, form, swage, bond, and separate materials. The work is bringing about a broader understanding of normal fabricating methods and will be followed by a new generation of equipment and techniques. Certain devices already employ pneumatics and hydraulics which had their origin in explosives.

Supply of Alloy Extrusions Will Increase This Year

—EARLE A. CHANNER

• Five basics will improve the state of the extruding art: Die design, improved die materials, closer and more suitable temperature control, improved lubrication, and billet improvements—both in surface and metallurgy.

We expect that more alloy steel extrusions will be available in the coming year. There will be more difficult configurations and a larger range of alloys.

The market for such products has to be developed more. The economics of the process fit the smaller requirements of shapes currently fabricated from solid bars.

Impact Machining Expected To Receive Wide Notice

—MELVIN D. VERSON

• Pressed metal people are making tremendous progress in impact machining. It applies the principles of cold extrusion to widen the variety of pieces.

It controls the flow of metal in any direction, combining backward, forward, lateral extrusion, and heading into one operation.

Gears, sparkplug shells, tappets, studs, bearing races, engine sleeves, and bearing retainers are being produced.

The primary advantage is economy. You can often use lower cost material—savings of 40 to 70 per cent are not unusual, and machining requirements are almost eliminated.

Expects Cold Extrusion To Become Routine Method

—C. C. CADITZ

• Three developments will have a great effect on metal stampers in 1959. They are:

Cold extrusion will become more of a daily production method; use of clad steels and aluminum will become more commonplace; and "stacked stampings" will find wider application. (Thick, intricately shaped pieces are built up by stacking stampings and brazing or riveting them together. They offer great cost savings in machining.)

Stampers efforts to focus attention on the "make or buy" question will bear fruit. Many end product manufacturers will find operating a stamping operation as a sideline excessively costly and will convert their investment and space into more profitable channels.

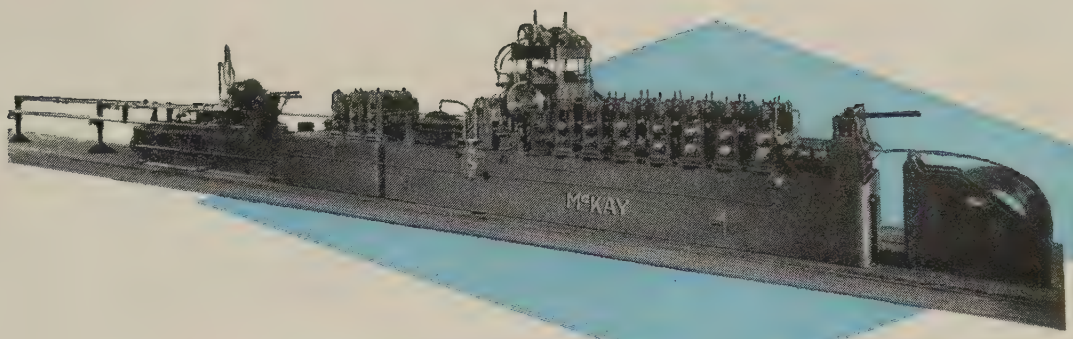
Better Auxiliary Equipment Needed To Up Steel Quality

—J. L. McMARTIN

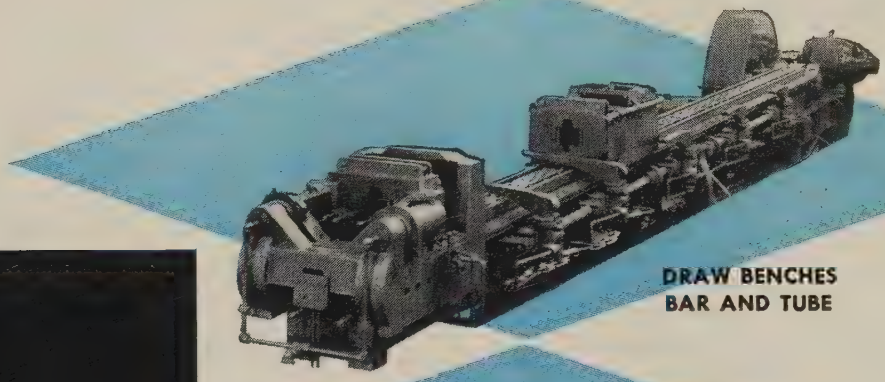
• Look for increased demand for rolled products of higher tensile material, made to closer tolerances and in special shapes, to reduce waste in fabricating.

The demand for tougher materials knows no bounds.

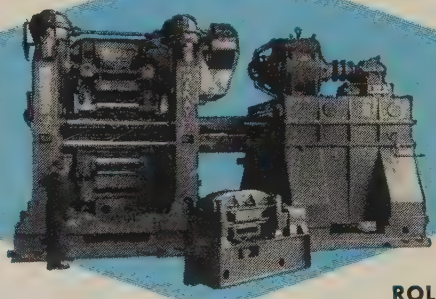
Suppliers of standard mill products have to resist increases in quality to meet tonnage requirements. But users need better quality to keep product and tool costs in line. To bring such opposites closer



TUBE MILLS AND
FORMING MACHINES

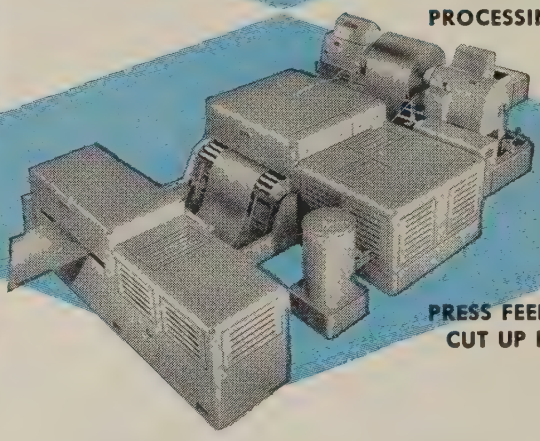


DRAW BENCHES
BAR AND TUBE



ROLLER LEVELERS,
PROCESSING MACHINES

Metal working Automation in action...



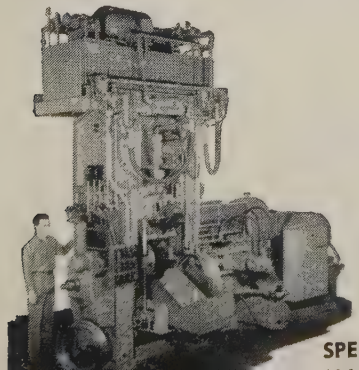
PRESS FEED AND
CUT UP LINES

If you're in the metal working business, you should be acquainted with McKay *automated* lines available for many metal working operations.

McKay pioneered and has played a leading role in the development of such equipment as that pictured on this page.

Basic McKay designs can be modified, or special machines developed to meet specific requirements.

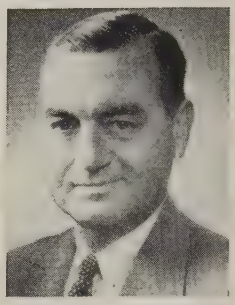
THE McKAY MACHINE CO., YOUNGSTOWN, OHIO



SPECIAL

McK

Forming



A. O. SCHAEFER
President, Pencoyd Steel & Forge Corp., Philadelphia

together, every angle must be exploited that will aid steelmaking quality. That includes improved payoff and take-up reels, automatic gaging, temperature control, automatic screwdowns, and improved handling equipment.

Continual development of shaping and forming by rolling can be expected.

The high material costs will undoubtedly lead to an increase in chipless metal forming.

Of increasing importance will be the specialty mill, engineered, designed, and manufactured for a specific kind of rolling.

It will embody improvements in electrical drive controls.

Ingot Improvement Is Key To Forging Progress

—A. O. SCHAEFER

• Open die forgers are finding more diversified uses for their product.

Demands for forgings, long important to steam and gas turbines, is expected to increase for many years. Forgings will have to meet increasingly severe service. Specifications and inspection techniques will reflect this. It will demand the best of metallurgy and processing.

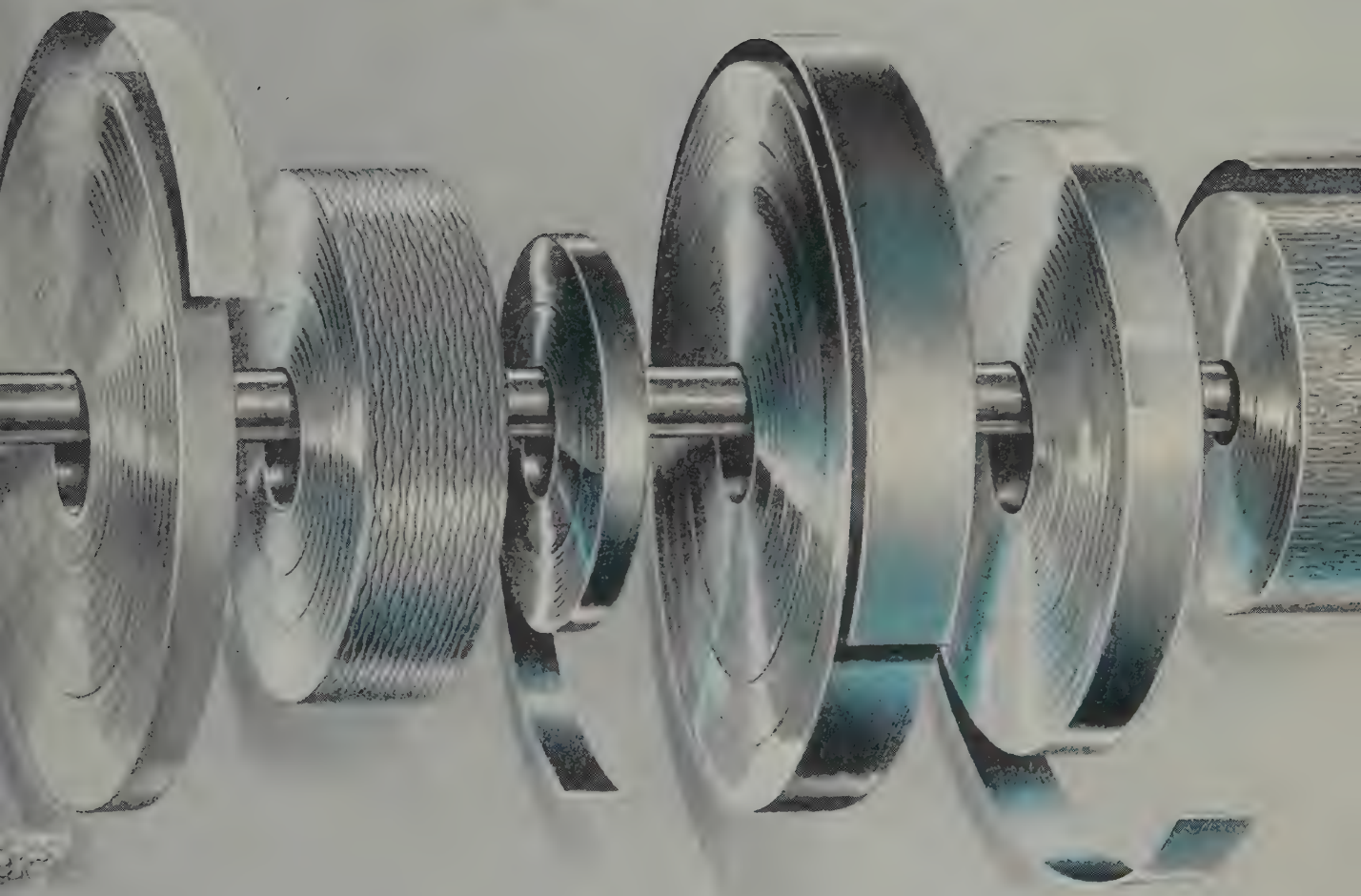
Forgings predominantly come from electric furnaces. This will be an active field since the ultimate in melting technique is yet to appear.

The forging press has been speeded up and equipped with handling facilities to increase output and reliability.

Modern inspection techniques leave little unknown in a piece of steel. Forg-

(*Please turn to Page* 350)

a big name in specialty steels



For missiles or mixers, rockets or razors—whatever your steel requirements —depend on Sharon for consistent quality . . . exactly to your specifications.

Sharon makes a complete line of chrome, chrome-nickel, chrome-manganese stainless, spring and high carbon, high tensile, coated, silicon—or any special alloy—open hearth or electric furnace, of any surface pattern, including the new rolled-in designs.

If you haven't already discovered this outstanding source of specialty steels, or the significance of Sharon Quality, make it a point to talk with a Sharon salesman at your first opportunity.

SHARONSTEEL

SHARON STEEL CORP.

SHARON, PENNSYLVANIA

Forming

J. E. HAWKING
Sales Manager
Pines Engineering Co. Inc.
Aurora, Ill.

ings in nuclear energy, guided missiles, and rockets, have forced our attention to weldability under adverse conditions and high temperature resistance.

There is increasing awareness that the root of our progress may be in the forging ingot.

Future improvements will develop from better steel ingots.

Range of Tubing Applications Broadened by Bending Press

—J. E. HAWKING

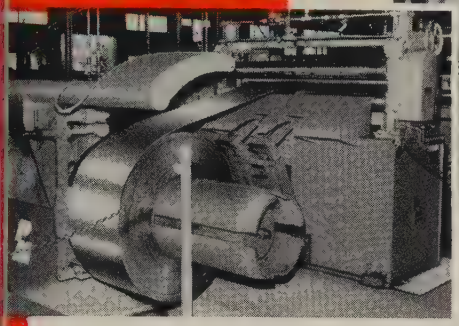
• Bending machines for tubing have a new blood relative: Tube bending presses. Unusual new refinements will be the big-best contribution in 1959. They double and sometimes triple today's production figures.

Small hydraulic presses with variable stroke, automatic index, and adjustable pressure cushions on wing dies, bend tubing progressively without mandrels. Ninety degree bends with section deformation comparable to mandrel bends have been made in 1¼ in. tubing on a 2¾ in. center line radius. It will produce 2500 bends an hour. Many other sizes are in production. Where production warrants, automatic feeds will multiply cost savings still more.

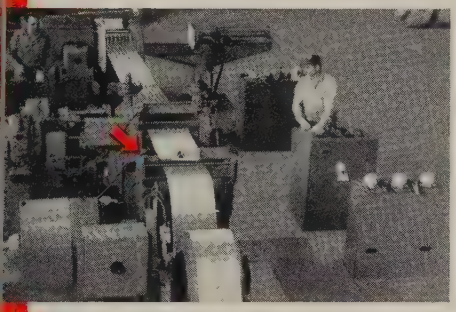
Rotary bending machines will be automated for a few applications. Tube and sections up to 10 in. will become common.

Aircraft benders will have controls reducing setup time. Design trends in aircraft and missiles will necessitate techniques developed for the heavy power

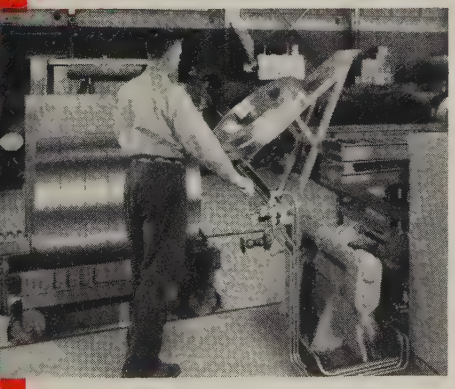
PM slitting lines are designed for efficiency. This complete, highly automated PM line in a warehouse handles a variety of metals — steel, stainless steel, aluminum, etc. The picture shows one of the time saving features of the line, a PM overhung arm separation device, used instead of heavy, individual large diameter discs.



PM uncoiler with a peeler that feeds into the flattener without manual handling — this device provides a safer, faster operation on this line, which handles gages up to 3/16", widths to 48", and coils as heavy as 30,000 lbs.



PM automatic edge control guides, .004 strip to slitter without edge damage on this light gage stainless line.



Automation in upending, banding, and downlaying coil saves time and dollars.

To get the kind of Slitting Line YOU need, use P/M PRODUCTIONEERING*

PM lines are built to fit the user's needs. To survey your needs, and determine the best answer for your requirements, make use of the first step in *PM Productioneering**, a talk with the PM man.

You will learn from him that PM Productioneered lines include heavy duty equipment (to handle up to ¼" gage steel); lines designed for lighter gages down to .002"; lines that handle a variety of metals including steel, stainless, aluminum, brass, copper; lines for a full range of coil weights up to largest handling by mills . . . Some are highly automated. Some are specially designed to fit difficult layout situations in crowded plants. Component parts of these lines are standard, but the flexibility of Productioneering tailors each line to the specific situation.

Flexibility in meeting individual needs makes PM lines differ, but PM Productioneering puts one common denominator into all PM products—maximum profits for the owner. Get in touch with a PM man today — there's no obligation.

Production Machinery Corporation
Mentor, Ohio

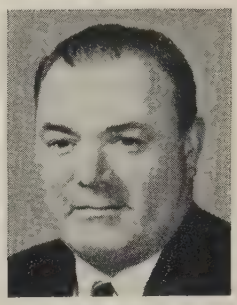
***PRODUCTIONEERING** is the P/M way of working so engineers who supervise equipment designing have first-hand knowledge of problems encountered by sheet and strip processing line users. In working with P/M you work with responsible engineers who apply their skill to solve your problems.

P/M PROCESSING EQUIPMENT INCLUDES:

Pickling Lines
Slit Coil Banding Equipment
Shearing and Cut-to-Length Lines
Grinding and Scouring Lines
Coil Build-up and Inspection Lines
Vacuum Handling Equipment
Continuous Lines for Annealing, Coating, Grit Blast Cleaning, Leveling and Miscellaneous Sheet and Strip Processing.

P/M

Forming



J. K. WINGARD
Manager, Press Engineering
E. W. Bliss Co., Canton, Ohio

boiler industry. We are able to bend heavy wall tubes to radiuses of one diameter with no appreciable wall thinning.

Conversion from metal removal to metal forming is no longer a trend: It is practice.

Bending machine operations are being used hand-in-glove with other new forming techniques by product designers in an effort to keep costs in line.

Presses To Be More Versatile, Have More Auxiliaries

—J. K. WINGARD

• We believe that cold extrusion and warm heading of ferrous and nonferrous materials will progress. The material savings and cost reduction make cold forming attractive to many.

Explosive forming is relatively new, and you can look for progress in this unusual method.

The emphasis in standard metal forming fields will be on improved designs which feature appearance and safety with improved speeds and handling. Standard presses will be made more versatile through auxiliary equipment.

Powdered metals will find added uses. Copper and pure nickel can be continuously rolled into strip.

We expect higher speeds to be available; we have some presses running at 1000 strokes per minute.

Technological problems yet to be overcome are in electronic controls for fast, precise actions, and measurements. Heat exchange improvement and lubrication advances also are on the way.

Here at The House of Stainless, we provide a metallurgical service that goes far beyond helping you select the type of stainless best suited to your application.

We can help you determine how best to work with the stainless selected. How best to handle such operations as machining, welding, soldering, drawing, forming, spinning, or the many other facets of fabrication.

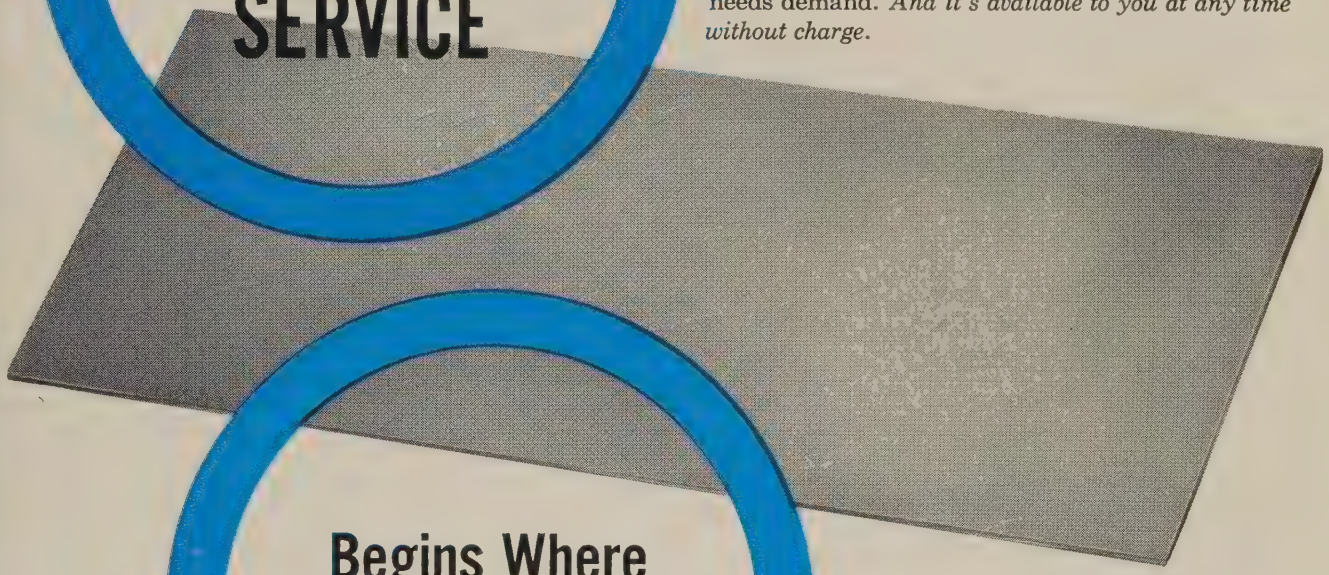
This help can include assistance in adapting your present equipment for handling stainless steel as well as counsel on set-up and operating procedures.

It can mean help in tool design for long life and economical production—plus assuring finished parts to meet your quality standards.

Important, too, is the know-how and experience available to you in exploring possible avenues for maximum economies both in fabrication and finished product.

In short, Metallurgical Service at The House of Stainless can be as broad and inclusive as your needs demand. *And it's available to you at any time without charge.*

This METALLURGICAL SERVICE



Begins Where You'd Expect It To End!

With our complete warehouse stocks, we can make prompt deliveries for normal requirements. Where mill shipments are called for, we are in constant touch with the leading stainless-producing mills to fill your requirements at no extra cost to you.

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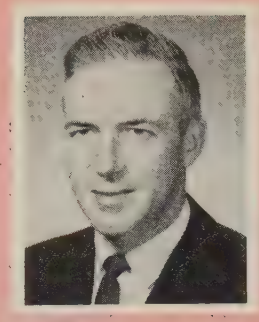
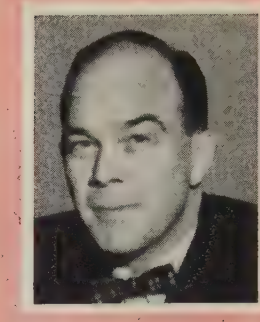


C. C. MARCH
Vice President, Coated Abrasives & Related Products Div., Minnesota Mining & Mfg. Co., St. Paul



GORDON RICE
Equipment Engineer
Turco Products Inc.
Los Angeles

1959 FORUM ON TECHNICAL PROGRESS

Cleaning and Finishing

Improvements Due in 1959 Cover Variety of Processes

—WALTER R. MEYER

• Significant improvements in metal cleaning, scale removal, electroplating and chemical treatments will occur in 1959.

Metal cleaning will be improved by the availability of new additives for chlorinated solvents to remove buffing compounds, new aqueous buffing compound removers, new chelate containing alkali cleaners for simultaneous cleaning and rust removing to eliminate acid dips and to shorten plating cycles.

New nonfoaming surfactants will permit the formulation of better spray cleaners.

Ultrasonics will find wider usage for solving difficult cleaning and oxide removal problems.

Powered acid salts containing fluorides and detergent materials will offer the user more efficient and less hazardous products for oxide and scale removal.

Electroplating improvements will include more ductile bright nickel plating, the use of multiple nickel coatings, much wider use of thicker crack-free bright chromium, chromium plating directly on aluminum.

Sintered metal parts as well as porous castings will be finished more effectively by wider use of "Peen" plating and antitarnish agents. Interest in finishing and plating on magnesium alloys is increasing and a new process for chemical reduction (electroless) plating of nickel has been offered to the market.

Some of the needs of the finishing industry include methods for the production of more uniform and durable colors on aluminum, methods for preventing refractory metals from oxidation at elevated temperatures including titanium, molybdenum, and columbium, noncyanide plating baths to ease waste disposal, water-rinsable materials for hot flowing of tin, bright tin plating solutions, methods for selectively precipitating impurity metals from plating solutions and methods for reducing or eliminating tarnishing of bare silver, copper, and brass. Work is being done on all of these problems and partial solutions will be offered.

Broader Potential Seen as Ultrasonic Units Progress

—H. F. OSTERMAN

• Today, transducer areas are measured in square feet, instead of square inches. Due to the steady reduction of costs, coupled with marked improvements in equipment performance, more and more processes are becoming technically and economically feasible.

To be sure, the cleaning of precision parts will remain one of the foremost uses for sonic energy. However, increased use for more diverse purposes and in large installations is imminent. In many cases it's a fact. In the nuclear field for instance, reactor components are being cleaned, and effort is being directed toward removing scale and pickling residue from high alloy tubing.

One of the most vexing problems is the erosion of the sound radiating surfaces caused by the mechanism which is responsible for cleaning: Cavitation. Solutions for this and other problems are on the horizon and should begin to make themselves felt during 1959.

Present trends in ultrasonic equipment of increasing quality and utility together with decreasing costs will continue. These factors will tend to expand the field of application to the point where ultrasonic processing will be commonplace in the primary metal industry.

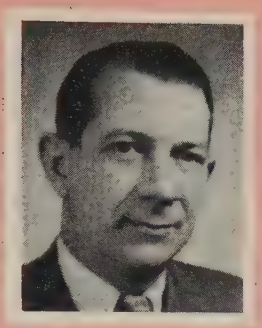
Coated Abrasives May Trigger Grinding, Finishing Revolution

—C. C. MARCH

• A revolutionary new product for metal preparation is being evaluated in the primary metal industries and has created a whole new range of architectural finish possibilities. In addition, it shows promise of reducing pickling time and the chemical consumption and metal loss inherent in pickling.

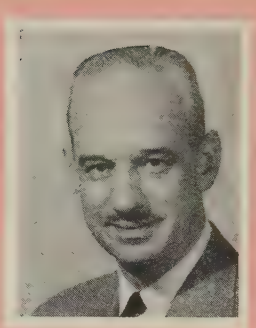
It is but one of new avenues we

WILLIAM P. INNES
Technical Director
MacDermid Inc.
Waterbury, Conn.



T. J. KEARNEY
Asst. Mgr., Industrial Equipment Div.
Detrex Chemical Industries Inc.
Detroit

E. J. KUBIS
Manager, Metal Finishing Sales
Wyandotte Chemicals Corp.
Wyandotte, Mich.



H. L. BENNER
Electroplating Service Manager, Sodium
Prod. Div., E. I. du Pont de Nemours
& Co., Wilmington, Del.

will continue to explore in 1959 to answer problems presented by new requirements for finishes and materials in the mushrooming aircraft and missile industry. Each new high-temperature alloy poses a potential grinding problem. Each new step into space offers a new problem in finish.

During 1958 there were many improvements in product lines; many standard coated abrasive products were upgraded or revised to meet new, more stringent industrial requirements. The result is that the consumer is getting more for his coated abrasive dollar than ever before.

Indications are that what's on tap for the sixties will possibly revolutionize present grinding and finishing methods. Certainly, it will broaden them far beyond present capabilities.

Low Temperature Phosphating Shows Big Potential

—GORDON RICE

• We predict that low temperature phosphating will be in almost universal use within the next five years.

Phosphate processes, which are applied by immersion or through an industrial spray washing machine, have until recently required temperatures in the 180° F range. Low temperature phosphating is done at 80 to 100° F. The coating is as good as those obtained with higher temperatures.

Savings in heating costs are immediately apparent. Imagine the fuel that might be required to maintain a 180° F temperature throughout an 11 stage spray washer, with the tremendous heat loss involved in a constant spraying operation. Also think of the drastic savings that can be effected when the washer can be operated efficiently at a temperature 80 to 100° F lower.

Not only is a tremendous fuel saving effected, but original equipment costs are lower, since the need for heating facilities is minimized.

Low temperature phosphating also minimizes maintenance costs. There is far less sludging. What little sludge is formed is soft, light, and nonadherent; it can be quickly and easily removed.

Advances in Finishing Solve Special Problems

—WILLIAM P. INNES

• Industry and professional societies have been studying the corrosion mechanism of copper and nickel and chromium coatings on steel and zinc base diecastings. It has been proved that the durability of these coatings on both steel and zinc base diecastings can be greatly improved by increasing the thickness of chromium and using a crackfree deposit.

There has been an increase in electropolishing of metals to produce a bright finish and remove burrs. The process produces a more corrosion resistant finish because of an improvement in surface finish.

Chemical processes are improved for smoothing, brightening, deburring, and producing highly resistant chemical films on aluminum, zinc base diecastings, zinc and cadmium plated steel, steel, copper, brass, and silver. Most of the chemical films can be dyed. The solutions can also be used to remove burrs.

Cleaning and Painting Now Done in One Unit

—T. J. KEARNEY

• The development of a system for cleaning and painting of parts within one integrated unit is expected to receive wide acceptance in metal finishing. In most cases, this new process requires no more floor space than that required for solvent degreasing. Savings in floor space, thinners, and operating costs will result. Overall savings of 20 to 50 per cent of the finishing costs are anticipated. Paint dip or flow coating can both be combined in a continuous process.

Paint and Buffing Compound Removers Will Be Improved

—E. S. KUBIS

• In 1959, plated finishes will be more corrosion resistant, paints will be tougher and more resistant to weather, and improved porcelain enameled finishes will be applied to aluminum in growing volume.

New, relatively inexpensive paint removers will be capable of quickly handling new epoxy and methacrylate finishes. The new paint finishes are resistant to the usual caustic soda type removers commonly used for economical paint removal.

The removal of buffing compound, a problem which has plagued industry for years, will show substantial progress.

There has been more progress in cleaners and allied metal finishing chemical specialties in the last five years than in the preceding 15 but the need for further progress becomes quickly evident as new production processes and finishes for metals are evolved. Right now, for example, a rapidly growing aluminum finishing industry needs better chemical brightening baths and better methods of plating on aluminum.

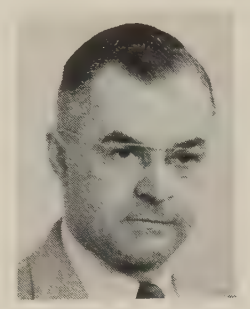
New Preplate Bath Levels Chromium Surface

—H. L. BENNER

• A new cyanide copper bath with marked ability to plate "leveled" deposits is expected to find wide usage on parts to be chromium-plated. Superior corrosion resistance is indicated because of the laminar structure of the copper in con-

Cleaning and Finishing

MYRON B. DIGGIN
Vice President & Technical Director
Hanson-Van Winkle-Munning Co.
Matawan, N. J.



E. S. GARVERICH
Mgr., Technical Service Dept.
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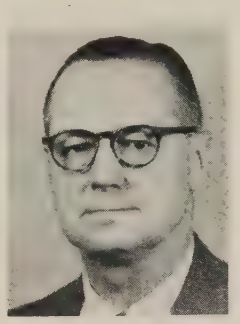
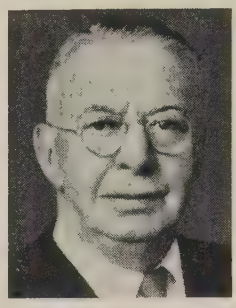
Philadelphia



ROBERT G. HALL
Special Engineer
Pangborn Corp.
Hagerstown, Md.



A. E. CARPENTER
Chairman
E. F. Houghton & Co.
Philadelphia

trast with the usual columnar-type deposit. The ability of the leveled bath to fill minor polishing imperfections in the basis metal is undoubtedly a contributing factor in its protective value.

A new double salt of sodium and copper cyanides has found good acceptance in the industry. A white salt made by drying a filtered solution of sodium cyanide and copper cyanide, it is readily soluble and offers definite advantages—high purity, simplified control, and convenience.

Competition Spurs Progress In Electroplate Finishes

—MYRON B. DIGGIN

• There is no question that anodized aluminum and stainless steel will continue to be used for auto trim in areas where their suitability has been demonstrated. Several limitations in producing bright anodized trim parts have been given considerable study recently. It is predicted that at least some of the problems will be solved and improved methods utilized commercially this year.

As usual, competition from other materials has stimulated those concerned with electroplated finishes to redouble their efforts to improve the durability of these coatings. The development of more informative accelerated corrosion test methods has given the industry a better yardstick for measuring the performance of these coatings.

Many producers of electroplated parts have already adopted improved plating methods, such as duplex nickel coatings under the chromium top coat, and they have recently found modifications in the conditions for chromium plating that produce a remarkable increase in the protective qualities of the nickel-chromium or copper-nickel chromium system. During 1959, these procedures will be written into many specifications. The resulting improvement in the durability of these bright coatings will unquestionably benefit the industry as well as the consuming public.

Metal Cleaners Marketed In New Package Sizes

—E. S. GARVERICH

• One of the things to watch in '59 is improvement in handling and packaging methods. For years, cleaning compounds and other specialty products used in metal finishing have been supplied in relatively standard 40 to 50 gallon containers. Now, the rising cost of packaging and handling has made bulk shipments of etchants, strippers, and similar items attractive to the large user.

Look also for the other extreme: New ideas in small packages of "addition-unit" sizes for the automation-minded customer.

Problem of the year: How can the various engineering groups maintain contact in the face of ever-increasing specialization? For example, when a press shop lube is selected, the finishing engineer should have an opportunity to observe its effect on finishing, a procedure endorsed but seldom followed in industry.

Possible solutions: 1. Rotation of engineers. 2. Project planning. 3. Greater reliance on "full line" suppliers.

Blast Descaling Methods Show Cost Advantage

—ROBERT G. HALL

• Descaling by steel shot or grit blasting has brought about a new era of production and greatly lowered costs to all producers of sheet and structural sheet parts. The process is clean and dry. In addition, it requires a minimum of space and investment, compared with other cleaning methods. It is adaptable to full automation when desired.

One of the areas for substantial potential growth of blast descaling is in low carbon steel hot strip cleaning lines, in preparation for cold rolling. Stainless steel producers are accepting this process. With a blast descaling cabinet in a hot strip cleaning line, two major economies show up at once: 1. Required acid immersion is cut yet tonnage is maintained. 2. Existing acid cleaning capacity can be maintained with greatly increased tonnage.

Continued research in product improvement has increased the life and efficiency of blast cleaning equipment. A new vacuum cast steel shot with a controllable quality feature of "continuous heat treating" is on the market and earning a splendid service record.

Water-Soluble Oils Aid in Metal Surface Treatment

—A. E. CARPENTER

• The desire to make a processing oil more readily removable has resulted in the use of water-soluble products where feasible. This has been done for years with cutting fluids, perhaps more for economy than for removability. Drawing compounds also are often emulsifiable to a degree, facilitating the cleaning. Now we see a similar tendency in quenching. Our German affiliate has marketed a water-soluble quenching oil, with this thought of easy removability in mind.

The cleaning of soil from metal surfaces often results in a clean surface subject to immediate rusting. A small amount of water-soluble rust preventive added to the last rinse will often serve to protect the parts from rust without adding an

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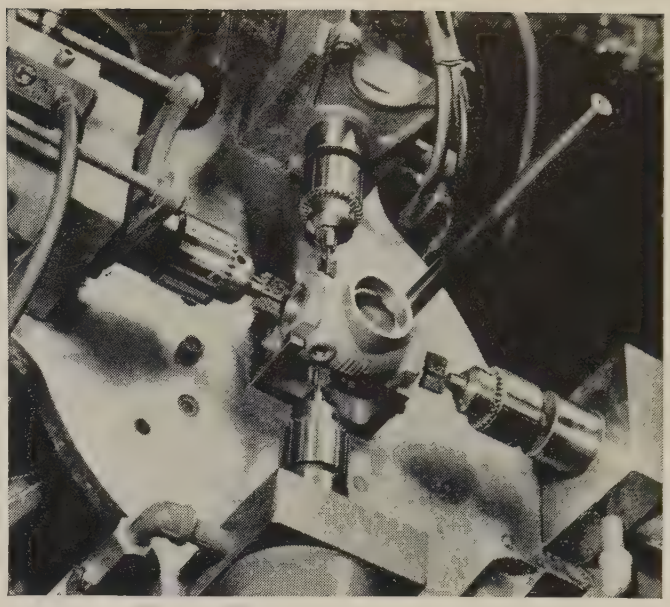

SPEED BURR REMOVAL—The 4 threaded ports in this valve body are being deburred and cleaned in one fast operation by Osborn Situft® Brushes and this simple power brushing setup. Doing the job by hand was slow, costly. Now Osborn Power Brushing does it 66% faster . . . saves 8 manhours per thousand parts.

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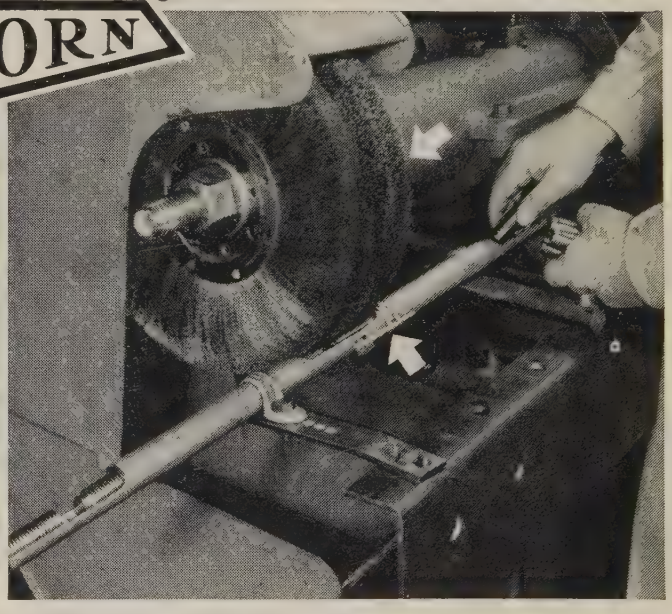
SPEED FINISHING—These aluminum ammunition components are finished at high production rates . . . to meet rigid quality control standards. Here, three Osborn Master® Wheels plus simple rotating fixture setup finish pieces at a rate of 1400 per hour. Feather burrs are thoroughly removed . . . surface junctures are blended uniformly to cut the cost on this job 74%.



SPEED CLEANING—For cleaning set-screw threads, this manufacturer relies on Osborn Power Brushing. Operator feeds screws into a simple pipe-fixture . . . Osborn Monitor® Brushes spin and clean them fast, thoroughly. A stationary Osborn Situft® Brush controls rotation and traverse of the screws across brush faces. Cleaning time is cut from 18 to 2 seconds per piece.

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Association Inc., Pittsburgh

HUGH D. McLEESE
Vice President
Metal & Thermit Corp.
New York

M. B. ROOSA
Executive Vice President
Parker Rust Proof Co.
Detroit

oily film that would require removal. Where an extremely light coating is desired, a variety of oil-and-water-soluble rust preventive can be diluted with a small amount of mineral seal oil.

Rust removal has also received new attention. Experimentally, liquid cleaners have been developed for alkaline derusting. Research progress has been made on etching of aluminum to give it a satin finish, by subjecting it to alkaline treatment.

Resin and Pigment Advances Portend Market Growth

—D. S. GAARDER

• Advances are rapidly shaping up in both resins and pigments.

In resins, immediate advances will probably stem not so much from new discoveries as from greater knowledge of how to combine resins more effectively. The trend is definitely toward paint films that will dry faster and combine superior hardness, improved flexibility, and greater resistance to wear, abrasion, chemicals, and exposure.

Improved pigments, greatly extending current color conceptions, are also in the offing. Cleaner, clearer colors will become increasingly available. These new colors will be much more permanent than many heretofore offered.

Many of the finishes growing out of the technological advances represented in resin and pigment improvement adapt themselves readily to emulsion formulation. Such emulsions are already in some water-reducible enamels and insulating varnishes.

One promising way to meet speed requirements is with the rapidly developing technique of strip coating. Precoating of metals for subsequent forming is no longer experimental. It is being used in a wide range of fabricating operations. Introduction of faster finishing methods, in turn, will require increased attention to metal preparation techniques.

Galvanizers Set To Stress Low Maintenance Costs

—STUART J. SWENSSON

• One of the most significant innovations is the galvanizing of structural steelwork for bridges. Because of the difficult maintenance problem involved, the durability of hot dip galvanizing is used to best advantage. This application is still in its infancy, but it appears to have a big future.

To meet the growing need for hot dip galvanizing, particularly in the realm of larger construction, the trend is toward larger baths and higher productive capacity, coupled with the full utilization of modern galvanizing techniques to insure the highest product quality.

Work is already underway to solve the problem of wet storage strain (it may afflict galvanized steel that is stored or transported under damp, badly ventilated conditions) and to further improve the performance of galvanized hot water storage tanks.

It is the industry's conviction that hot dip galvanizing provides the best low maintenance rust protection for steel. You will see galvanizers press that claim to the limit this year.

Heavier Chromium Plate Tackles Corrosion Problem

—HUGH D. McLEESE

• One of the most recent significant developments in electroplating is the increasing awareness that greater thickness of chromium can provide improvement in corrosion resistance far in excess of the relative increase in total plate thickness.

For nearly 30 years, chromium deposits of about 10 to 20 millionths of an inch have been standard. Greater thicknesses were not used because of excessive cracking. While chromium itself does not corrode, it cannot, when 10 to 20 millionths thick, seal out corrosive materials that may attack the base metal. So ways of increasing the thickness of chrome plate and, at the same time, making it free of cracks, have been sought for some years.

Successful methods of producing heavier, crackfree deposits for industrial applications were introduced some five years ago. It is only within the last year or so, however, that bright, crackfree chromium in thicknesses of 30 to 100 millionths have become commercially feasible for decorative use.

While such deposits may be produced with ordinary chromium plating baths, self-regulating baths are preferred because they have greater throwing power and are easier to control. In either case, they provide an impervious layer of chromium which prevents corrosive materials from reaching underlying coats of nickel and copper or the base metal.

Demand for Finished Aluminum Spurs Process Development

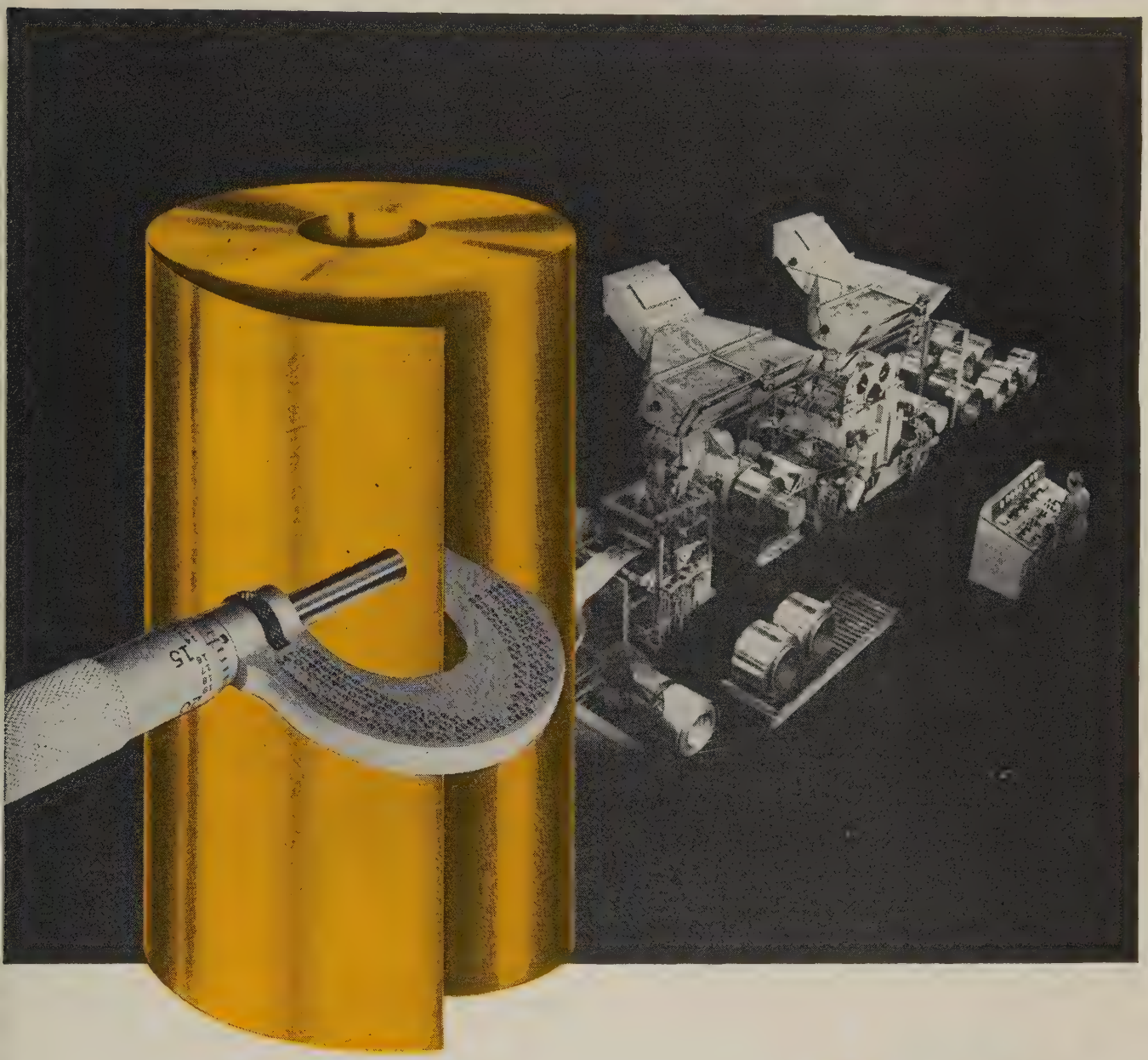
—M. B. ROOSA

• The rapidly increasing use of painted aluminum foretells new and greater demands for chemical coating materials. Newly developed processes for treating aluminum prior to painting offer increased efficiency. The coatings produced on the aluminum are either of the chromate chromic-oxide type or the chromium phosphate type.

Until recently, it was necessary to discard treating baths after relatively short

When Brass Strip Tolerances Call For

PERFECTION TO THE "Nth" DEGREE



Possibly, you've never seen—or even heard of—a Sendzimir Rolling Mill like the one pictured above. Not many people have. But if you use close-tolerance brass, copper or bronze strip, you'll certainly appreciate what these high-speed, precision units can do when you order Bridgeport Sendzimir-Rolled Strip.

These mills—now in operation at Bridgeport's plants—are capable of rolling light-gauge strip into economical, long-length coils to meet the most rigid gauge tolerances.

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Detroit

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Service Manager, Chlorine Prod. Div.
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Wilmington, Del.

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President
Allied Research Products Inc.
Baltimore

use due to the rapid buildup of impurities. The new conversion coating baths utilize ion exchange through which a portion of the bath is circulated to control the buildup of impurities and maintain a processing solution of constant chemical balance. Such baths can be used indefinitely to produce consistent high quality coatings on aluminum at uninterrupted high production rates.

Formability of prefinished aluminum will lead to the production of chemically treated and painted strips and sheets at the mills of the basic aluminum manufacturers and in large job shop operations.

The cold phosphate systems for steel will undoubtedly have an even greater impact on the metalworking industry in 1959 than it did last year. The processes, which operate at about 100° F, have fully demonstrated that heat savings of 70 per cent and greater are possible. The phosphate coating materials coupled with effective low temperature cleaners will find increased use as the economies in heat, water, and electricity are more fully realized.

Platers Set Goal: Better Quality Control, Reduced Costs

—JOHN V. DAVIS

• Manufacturers are becoming increasingly interested in methods of quality control and the savings that it can bring about.

Quality control is of particular importance to a plater because his is usually the last operation performed on a product before packaging for delivery. Unfortunately, it is only after plating that previously overlooked defects are often found.

We have also noted that manufacturers are becoming more interested in cost savings that can accrue through changing from a bulk handling operation in plating to a straight line operation with frequent inspections. Handling is cut down, damaged pieces are reduced, and a considerable area of floor space can be made available for other purposes.

The automatic plater is in itself an assurance of higher quality because it reduces chances of human sequencing errors, governs times in process tanks exactly, and operates at a steady production rate.

Vapor Degreasing, Finishing Due To Be Integrated

—J. J. HARGARTEN

• A threshold to be crossed in 1959 is the integration of vapor degreasing with metal finishing processes, such as prosphatizing and nonflammable painting. Two developments will make this possible: Painting systems based on trichlorethylene-thinned paints, and a phosphatizing process in which trichlorethylene is the reaction medium. Integrated degreasing-finishing operations reduce over-all investment and operating costs as much as 50 per cent. They give promise of automated cleaning-phosphatizing-painting lines which will produce high volume, high quality work at low cost.

A revolutionary development in phosphatizing is the anhydrous phosphatizing process carried out in a trichlorethylene system. Combination of the anhydrous phosphatizing process with a prior vapor degreasing cycle will reduce the size of equipment needed and will minimize solvent and chemical costs. Operation of a nonaqueous system will sharply reduce utility costs because of the low latent heat of the solvent and because of the elimination of oven drying prior to painting. The low investment required for the smaller equipment will make automation practical in many places where it was overexpensive. Commercial application of the new anhydrous phosphatizing process will get underway early this year.

Integration of the two new finishing processes with vapor degreasing in one piece of equipment will follow.

Electroplating May Be Wed to Organic Protective Coatings

—H. C. IRVIN

• We are engaged in promising research on the use of electroplated metals in unconventional combination with organic coatings for finishes that will combine decorative effects with best corrosion protection. There are encouraging signs of improved paint base preparations for steel for higher corrosion resistance as a basic requirement. Also, new methods of preparing metals for paint may increase the protectiveness of paint, as compared with plated coatings. Attention is also being given to the potential use of a bright acid zinc plate in copper-nickel-chrome systems with the prospect of greater corrosion resistance for decorative finishes.

In the field of mechanical finishing, it appears that a combination of mechanical and chemical finishing systems can appreciably reduce the handwork.

We believe our planning for new products cannot stop with the product itself. Where our product is part of a complete process, considerations must be given to operations or treatments before and after the use of the product. Methods, equipment requirements, and other factors affect the performance of the over-all process.

Process and equipment must be designed and planned together to provide maximum results at minimum cost.

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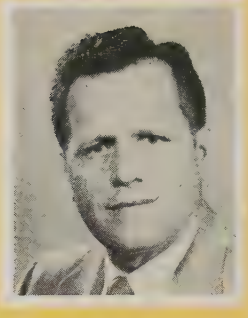
FRED L. PLUMMER
National Secretary, American Welding Society, New York

A. N. KUGLER
Chief Welding Engineer
Air Reduction Sales Co.
Division of Air Reduction Co. Inc.
New York



A. L. JEROME
Plant Metallurgist
Caterpillar Tractor Co.
Peoria, Ill.

I. W. EVANS
Chief Welding Engineer
Morgan Engineering Co.
Alliance, Ohio

1959 FORUM ON TECHNICAL PROGRESS

Joining and Assembly

Industry Eyes Ultrasonic Welding, More Automation

—FRED L. PLUMMER

• All indications point to more welded fabrication. Accelerated research, made necessary by nuclear power and high temperature operations, will uncover new materials and new welding processes.

Ultrasonic welding will be used for more materials and greater thicknesses. New refractory materials and special alloys will be developed and welded to meet the extremely high strength, high temperature, low weight requirements for rockets, missiles, and planes.

This week, the American Welding Society became American Secretariat for the International Institute of Welding, which represents 27 nations. By participating in this activity, industries in the U.S. can exchange welding information and assist in the development of the standards, codes, and procedures under which we may have to compete in both domestic and world markets. To supplement that program, the society has established a department to provide information and technical aid to metalworking industries.

Modern fabrication methods call for closer tolerances, greater accuracy, and higher skills. New techniques are based on greater mechanization—use of more automatic and semiautomatic welding processes with carefully designed and frequently extensive jigs and fixtures.

Suggests Broader Application Of High Temperature Brazing

—A. N. KUGLER

• The most important development in brazing will be the size and scope of furnace brazing with inert atmospheres.

Although high temperature brazing is used almost exclusively for honeycomb components, there is no reason why it will not soon find use in other industries where high service temperatures are required.

We need new brazing alloys which will permit flow control at brazing temperatures.

Present alloys are suitable to about 700° F. An alloy which will perform at 1000° F is needed—and it looks like such materials are on the way.

User Offers Recommendations To Makers of Welding Products

—A. L. JEROME

• Welding offers many economical answers to complex design problems. But much remains to be done in more practical approaches. Increased use of high strength materials will stimulate interest, and supply a real challenge.

There is need for basic weld standards which are more closely linked with applications. They also must be commonly understood and accepted—that way a fabricator can encourage the designer to apply welding and to look to the manufacturer of welding products for assistance.

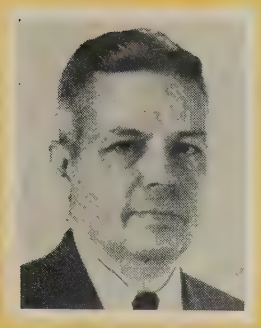
We ought to have enough flexibility in composition to get the strength, soundness, and workability we want in a weldment. We need more consistent ways to evaluate weld products and to correlate them with destructive laboratory and field tests. Until then, we will be only estimating weld performance.

Other needs include: More practical recommendations of the power source for each electrode to obtain the most efficient depositions; study of the effects of various heat inputs on high strength steels; ways to substitute automatic, semiautomatic, and resistance for manual, open arc welding; standards to govern the feedability of electrode wire; and the elimination of weld porosity, or more realistic tolerances.

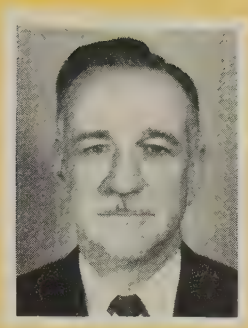
Positioners, Fixtures Offer New Route to Savings

—I. W. EVANS

• Welding has reached the age of general acceptance. All emphasis is on new processes, such as CO_2 welding, semiautomatics, and automatics. Fixturing is still one of the main problems that require investigation. The majority of welding jobs will be done manually for some time. Iron powder electrodes help manual welding retain a great deal of its advantage and versatility. It is difficult for automatics

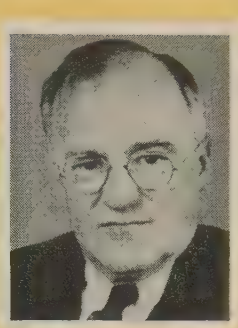


J. BYRON JONES
President, Aeroprojects Inc.
West Chester, Pa.



WILLIAM G. WALTERMIRE
Chief Product Engineer
Lamson & Sessions Co., Cleveland

RALPH S. BATTLES
President, Judson L. Thomson
Mfg. Co., Waltham, Mass.



A. F. DAVIS
Vice President
Lincoln Electric Co., Cleveland

to reach restrictive areas and to justify the expense where duplication is unusual.

Positioning is where great economies can be effected. Most equipment requires lengthy, expensive setups to fasten the workpiece. More attention should be given to that area.

We hope that someone will develop a simplified tracing device for the submerged arc process or CO_2 welding for complicated shapes.

The picture also looks bright for the development of new welding techniques for the more recently developed alloys.

Look for Big Advances In Ultrasonics Technology

—J. BYRON JONES

• Ultrasonic welding is handling new and difficult joining problems. Here are some highlights of what's being done and what's ahead:

Aluminum foil packages can be sealed at high speeds. Roller-type equipment makes seamwelds which meet rigid helium-leak specifications. Equipment to handle heavier aluminum is on the way.

Such welding does not demand extensive precleaning. Equipment installation is inexpensive, and power demands are low.

Better transformers and lower cost motors are made possible by joining aluminum foil to copper terminals. Such joints often can be made without stripping insulation.

Higher quality, cheaper transistors are made possible by joining fine aluminum and gold wires to germanium and silicon without heat or electric current. (Sparking or sputtering of resistance welding contaminates high-purity materials.) Similar encapsulation of semiconductors is practical.

Bridgewire assemblies, detonators, and electrical parts can be used at higher temperatures. Solder formerly restricted use to low temperatures.

Junctions of dissimilar metals are feasible (for example, stainless to aluminum or titanium). This means high quality, lightweight structures that will stand up to high temperatures. Ultrasonic bimetal welds avoid the metallurgical mixtures which have the unknown corrosion susceptibility of fusion methods. (Galvanic coupling, of course, is still present.)

High temperature metals like molybdenum, beryllium, 17-7 PH stainless are increasingly important to the Space Age. Joining them without reducing their strength is imperative. It is possible to join such metals without high weld zone temperatures or reduction of essential properties, but more research is needed.

Ultrasonics has enormous potential in many other metalworking fields besides welding, cleaning, soldering, and brazing. Examples: Much has been done with metallurgical degassing, grain refinement, diffusion, and dispersion.

Here are some general developments coming within the next five years:

1. Ultrasonic vibration will satisfactorily disperse solid metal and refractories throughout a melt as it freezes in the mold. The method will produce alloys which are today thought difficult.

2. Ultrasonic vibration applied to molten baths will produce hot strip coatings and improve quality.

3. Ultrasonic vibration impressed on a cutting edge, chipmaking tool (like those on lathes and planers) can cut power requirements, increase speed, and improve surface finish. (Reason: Cutting a slice of bread is easier if you move the knife back and forth--we call it oscillatory shear.)

4. Other high force application, like drawing, extrusion, pressing, and similar squeeze-forming operations, can become easier with ultrasonic vibration. Such applications require further development.

A new device which puts ultrasonic energy where you want it more efficiently has much to do with the success of metallurgical applications like those just mentioned. We call it a "force insensitive, transducer coupling system." You don't lose such large amounts of vibratory energy through supporting members of such a system. Other problems like frequency shift and resonance are eliminated.

Predicts Wider Acceptance Of Thread Standard

—WILLIAM G. WALTERMIRE

• Now is the time for manufacturers to review their fastener and special product designs. New processes like impact extrusion have changed our concepts of what can be made by extruding, heading, and rolling. Old barriers are falling fast: Some gains in quality, cost, and material savings are fantastic.

As 1959 progresses, fastener people expect industry to extend the inch-using unified screw thread downward to #0, to accept the entire range as an international standard, and to develop international standards for gases and gaging practices.

We have every reason to believe that '59 will be a banner year, as well as a forerunner of still greater production in the future.

Calls for Higher Quality Rivets at Lower Cost

—RALPH S. BATTLES

• Customers will continue to demand more speed, higher quality, and lower costs. Such requirements can't be met without the full co-operation of those supplying our basic materials. A precision rivet cannot be made without quality materials.

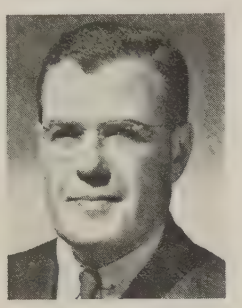
Industry doesn't buy the rivet alone. The tendency is to be more concerned with a package: Engineering, production method, rivet setting machinery, and the rivet.

High Inspection Costs Hamper Welding Progress

—A. F. DAVIS

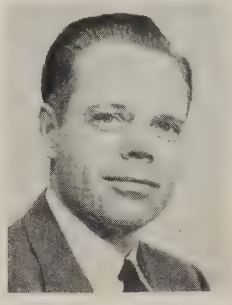
• Most welding developments have been putting more control into the machine and less in the operator's hands. Costs

Joining and Assembly

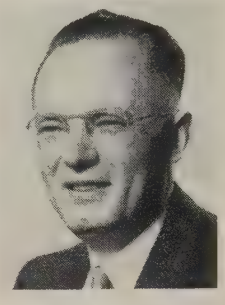


H. F. HENRIQUES
Vice President, Marketing Services
Air Reduction Sales Co., division of
Air Reduction Co., Inc., New York

DR. F. R. HENSEL
Vice President, Engineering
P. R. Mallory & Co. Inc.
Indianapolis



ROBERT C. SINGLETON
Vice President, Engineering
Nelson Stud Welding Div., Gregory
Industries Inc., Lorain, Ohio



J. V. LESTER
Treasurer, Standard Pressed
Steel Co., Jenkintown, Pa.

are reduced, and quality is more consistent.

The introduction of such advances creates technical problems, but welding must also clear another hurdle: Finding better ways to inspect and how to interpret what is observed by an inspector. Inspection costs frequently exceed those of welding, and much of the cost advantage of new processes is lost. In many states, for example, the question of inspection is adding considerable cost to welded bridge construction.

Stainless Powder Electrodes Have Big Potential

—H. F. HENRIQUES

• Several recent developments are bound to have tremendous impact on metal fabricating. They include special power supplies and process techniques for the gas shielded, metal arc welding like the CO_2 process, and the availability of low alloy steel wire which can weld high strength, notch-tough steels.

Metal powder, stainless steel electrodes will be a great boon. New iron powder type electrodes improve weld quality, are easier to handle, and provide faster rates of deposition. At the same time, they fulfill the rigid requirements of new government specifications.

One of the most urgently needed construction developments is an improved way to control quality and economy in field welding. There is a trend to limit the use of welding to shop fabrication and to make field connections with high strength bolts.

Another urgent need involves brittle fractures in pressure vessels and large field-erected structures: A proper correlation between the results of laboratory tests and the behavior of structures must be established. Lack of information on the correlation of test results causes undue conservatism, which needlessly increases costs. Fundamental information is needed to define the importance of various factors that might contribute to brittle failure, including: The properties of steel materials and welded joints, influence of welding procedures and fabricating methods, details of design, residual stresses, and heat treatments.

Tough Metals Will Gain During the Next Decade

—DR. F. R. HENSEL

• Interest in refractory transition metals (tungsten, molybdenum, tantalum, columbium) has increased greatly. They will open up new horizons in many fields, particularly in high temperature structural materials. New approaches in melting, advances in powder metallurgy, and stepped-up research will stimulate their use.

Example: Electron beam melting which produces high purity materials under high vacuum. (Heat comes from a gun which bombards the stock with electrons.) From the production standpoint, this process has important advantages. The material can be in ingot, powder, flake, or sponge form, and the process can be stopped or started at any time.

Looking several years into the future, one cannot help but see great promise for refractory metals, not forgetting vanadium and chromium.

A new high temperature titanium alloy represents a significant technical stride. A substantial price reduction will make it more attractive.

During the next decade, we think that all these metals will grow in importance.

Improvements in Studwelding Will Broaden Applications

—ROBERT C. SINGLETON

• You will see studs of larger diameter commercially available this year. Flux filled, $\frac{7}{8}$ in. studs will be readily handled with portable equipment. Studs $1\frac{1}{4}$ in. in diameter will be used in the shop—present upper limit is 1 in. The larger studs will be especially useful in composite steel and concrete bridges and buildings as standard as shear connectors. The larger sizes will offer economies to forgers.

Look for gains in aluminum studwelding and a collar stud for attaching metal roofing and siding to steel buildings.

Suggests Bolder Outlook Will Produce Better Fastener

—J. V. LESTER

• With the increasing complexity of mechanisms, the small fastener casts a long shadow on the success or failure of an assembly. Manufacturers of threaded parts can no longer consider their processes adequate. Closer tolerances will be demanded, along with higher strength and longer life.

Automation and greater service from all end products highlight the need for reliable fastenings. Standards will be raised to new levels, and reliability information covering components will become a necessity.

We must aim for a better product, not by mere percentages, but by a genuine increase. We know it is feasible to make fasteners for advanced applications with tensile strengths up to 300,000 psi. That's almost twice the strength of the best fasteners several years ago. Fatigue strength

YOU GET PRECISION FASTENING AT MASS PRODUCTION COSTS...

. . . when Thomson becomes your fastening partner.

In the Thomson line of more than 8,000 rivet designs, you'll find the semi-tubular, deep-drilled, bifurcated (split), shouldered or compression rivet that will give you the best strength-cost ratio in the fastening field. Produced to the industry's highest quality standards at production rates exceeding 20,000,000 rivets a day, these low-cost fasteners merit serious consideration in your product-improvement and cost-reduction programs.

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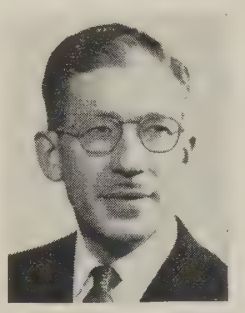
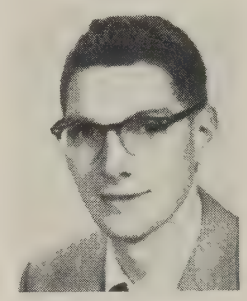
Joining and Assembly

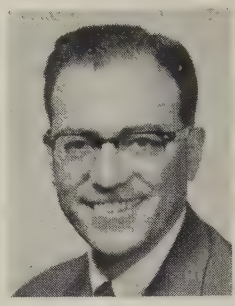
JOHN J. CHYLE
Director, Welding Research
A. O. Smith Corp.
Milwaukee



A. F. CHOUINARD
Director, Research & Development
National Cylinder Gas Div.
Chemetron Corp., Chicago



G. N. WILLIAMS
General Manager
Fusion Engineering Co., Cleveland



A. M. SETAPEN
Manager, Brazing Div.
Handy & Harman, New York

in the same time has gone up in proportion.

The key to the future lies in bold individual interpretation. To produce a fastener that will really perform calls for a new look at machines and men.

The "sixties" may well become the decade of reliability. Certainly, the little things will gain increasing importance; functional failures, though more likely, will be reduced. Emphasis in the fastener industry will be on more standard and interchangeable parts and greater dimensional fidelity.

Two Welding Methods Lead: CO_2, High Cycle Resistance

—JOHN J. CHYLE

• The carbon dioxide welding process will become increasingly important in fabricating carbon steels.

Carbon dioxide spotwelding has aroused considerable interest and undoubtedly will find a place in joining light sections, particularly in automobiles. It looks equally good for tackwelding and strength welds. To a certain degree, it may compete with conventional resistance spotwelding.

There are modifications of the CO_2 process, which incorporate flux. They will probably find a limited field in metal fabrication.

High cycle resistance welding is of great interest. Developments are rapidly being made. It has vast possibilities for light gage materials. Speeds of 1000 fpm in 0.012 in. metal are a fact. Mills making brass, copper, copper alloy, and aluminum tubing products are in production with this new process. Welding speeds are quite high.

Aircraft people are putting a lot of effort into honeycomb sandwich construction. Marked improvements have been made in the brazing, which will mean that large areas of honeycomb will be in the newer aircraft.

Honeycomb progress has upgraded the brazing alloy itself. High temperature, high strength fabrication is on the threshold of production success.

Iron powder electrodes continue to move toward higher speeds and higher deposition rates.

Progress of Welding Tied to Automatic Controls

—A. F. CHOUINARD

• Improvements in welding depend on our ability to further mechanize oxygen cutting, to improve arcwelding, and to develop better inspection techniques.

Some improvements have been made, but they should be regarded as guideposts.

Recent developments in gas cutting torches and tips have improved flame cutting. The next step is in machines: Some of them can photoelectrically trace an ordinary line drawing which eliminates the need for special templates.

Future improvements must combine the versatility of present machines with techniques being developed in automatic controls.

A basic arcwelding improvement started with CO_2 gas shielding a bare wire electrode to replace conventionally coated electrodes. That caught on quickly because the welder can see what he is welding, and put down more weld metal.

The next step was to add flux in the core of the wire. That opened up a new vista of electrode design. Flux-cored electrodes have allowed the designer to properly proportion his ingredients and to deliver them directly to the weld pool.

Improvements have been made in the last few years in both methods and equipment for inspecting welds. Properly used, they clearly indicate weld quality. The industry can use faster methods of nondestructive testing.

Cites New Opportunities for Paste Brazing and Soldering

—G. N. WILLIAMS

• New automation processes for silver brazing and soft soldering are rapidly being developed to fit new process developments. In large measure, the advances have been made possible by the several new (ST) brazing paste alloys which can be varied to fit each job.

In the past, such paste solders sometimes required elaborate setups. Simple, inexpensive automatic and hand applicators can dispense an exact "preform" of paste to the parts as they are fed to the heat source. Automatic heating devices then complete the brazing cycle.

Soldering developments hold promise of breaking 50 years of low efficiency.

Coming: Better Filler Metals To Resist High Temperatures

—A. M. SETAPEN

• The steady rise of operating temperatures in supersonic flight power reactors increases the need for joints capable of holding up at 1800° F. Makers of brazing alloys are concerned with broadening the variety of filler metals.

Work in progress should result in several new ones to supplement the nickel-chromium-boron-silicon alloys.

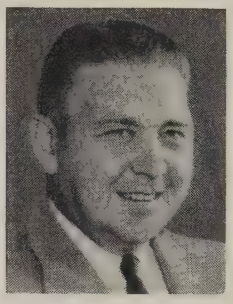
Although high nickel materials are strong and oxidation resistant up to about 1900° F, they tend to dissolve

(*Please turn to Page* 369)

Joining and Assembly

DAVID SCIAKY
President, Sciaky Bros. Inc.
Chicago

E. F. HESS
Product Manager, Adhesives
Coatings & Sealers Div.
Minnesota Mining & Mfg. Co.
Detroit



LAURENCE H. FLORA
Director of Sales
Tinnerman Products Inc.
Cleveland

JOHN S. DAVEY
Vice President, Research & Engineering
Russell, Burdsall & Ward Bolt &
Nut Co., Port Chester, N. Y.

and penetrate stainless steel, ruling out use on thin gage structures. Another problem: They form brittle intermetallic compounds with the base metal.

Four filler metals are in use or under test for 800 to 1800° F service: Gold-nickel, gold-nickel-chromium, palladium-nickel-chromium, and manganese-nickel. The first two offer the same advantages as high-nickel alloys without their limitations. The material is costly, but the applications requiring high temperature reliability far outweigh the cost factor.

Palladium-base alloys may be a good compromise material where high costs are a factor. One composition (palladium-nickel-chromium) has a flow point of 2300° F, the same service temperature as gold-nickel-chromium, and is reasonably ductile.

Manganese-nickel is getting established for moderately elevated temperature service above the range of silver-copper. It has a flow point of 1870° F, offers good strength to about 1600° F, when not subject to oxidation. It can be used at 800 to 900° F in a moderately oxidizing environment.

Marketing Problem Outweighs Need for Technical Growth

—DAVID SCIAKY

• The outlook for resistance welding does not depend on technical development. It is already far beyond present needs.

Industry's acceptance of the process is the key. Efforts to upgrade proper applications are just beginning to show results. The key to our future still lies in the ability to fasten safely and positively.

Nonaviation manufacturers offer real potential.

The development of equipment will no longer suffer from restricting such activities to the user's own staff. They will depend more on the machine builder.

In aviation, progress in resistance welding seems to have reached a plateau. Attention is turning to the exotic forms of automatic fusion welding.

Practical production of sandwich structures is yet to be solved. Fabrication of all steel aircraft is going toward a combination of automatic fusion welding and resistance welding.

The new steel alloys are easier to resistance weld than aluminum alloys.

The outlook is bright. We must emphasize our efforts to pioneer.

Instantly Curing Adhesives Sought for Production Lines

—E. F. HESS

• High strength structural adhesives will make appreciable gains in the next three years.

Aircraft designers look forward to when all mechanical fasteners can be replaced with adhesives.

Adhesives for high temperature applications are important to the progress of this joining method. Structural adhesives have maintained good strength at 400° F. The limit is expected to reach 600° F soon.

Instantaneous curing methods for high strength structural adhesives are being sought for production operations.

Use of new film adhesives will increase in the next few years. They meet the need for a high strength adhesive with simple application procedures. Film adhesives have uniform thickness throughout the joint, confine themselves to the immediate bonding area, and are clean. They don't contain solvents; waste and shrinkage are avoided. Some films won't disintegrate at 10,000 psi. They will hold 1000 psi at 500° F.

Looks for New Fasteners To Cut Assembly Costs

—LAURENCE H. FLORA

• Estimates show that assembly accounts for about 30 per cent of total costs. (Some jobs can run to 80 per cent.)

Going into 1959, fastening has gone a long way beyond nut and bolt methods. New techniques greatly simplify and accelerate assembly by cutting down the number of parts being handled.

Special spring steel fasteners perform many other functions beside fastening.

Such multiple service will bring more economies during the coming year. New fasteners types are being developed.

Three Reasons Cited for Fewer Standard Fasteners

—JOHN S. DAVEY

• Despite special purpose fasteners, there is a long term trend to fewer standard types and sizes of nuts and bolts. Reasons: They are simpler, cost less, and are easier to replace.

Assemblers' standardization on hexagon heads has already replaced square heads and nuts. Eventual goal of this standardization program: Two fastener combinations to meet all applications, except Spin-lock bolts and nuts. They will do the same jobs now done by a dozen combinations at less cost.

Association fastener standards are due

Joining and Assembly

A. WATSON ARMOUR III
President, Huck Mfg. Co.
Detroit

for some changes. Some call for overdesigning in 60 per cent of the cases. Since changing thread dimensions and distance across flats would create interchangeability problems, reduction of nut thickness is most likely.

Heat treated bolts continue to gain favor. They cost less than cap screws and machine bolts.

The trend toward heat treated bolts highlights greater understanding of fasteners.

Emphasis on proper assembly has also accelerated a trend to power wrenches and mechanized assembly.

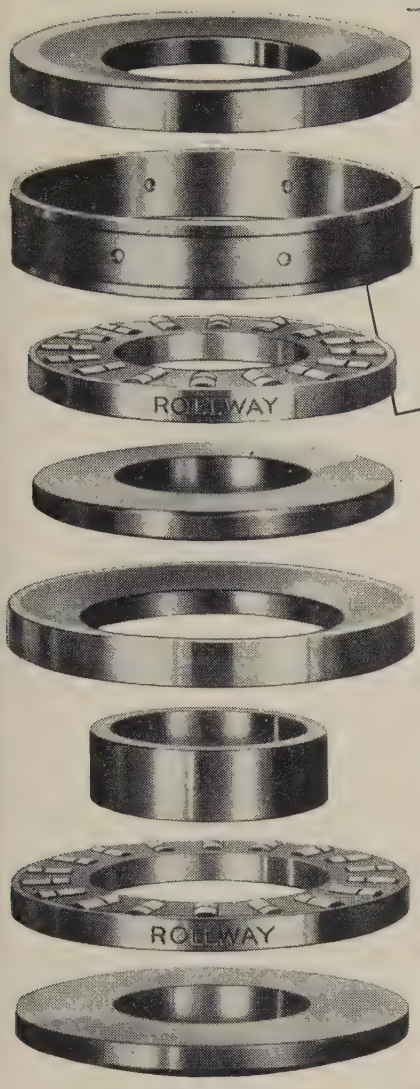
High strength bolting techniques are moving into the repair and upgrading of equipment. Fabricators of buildings, bridges, and railroad and heavy construction equipment will use more high strength bolts.

Fasteners Needed for Service At High Temperatures

—A. WATSON ARMOUR III

• The trend toward fasteners capable of working in higher temperatures is expected to continue throughout 1959. Among the newer fasteners meeting that need is a Conical Keystone Lock (CKL) blind rivet made of Monel. Now a prototype, it is expected to qualify for 1000° F service.

Hole-sizing fasteners, which automatically bring drilled holes to precise size during installation, are products of a brand new concept. They will be used in interference fits for leakproof construction. The performance permits use



2 to 3 times Greater Thrust Capacity

8 to 12 times Longer Life Expectancy

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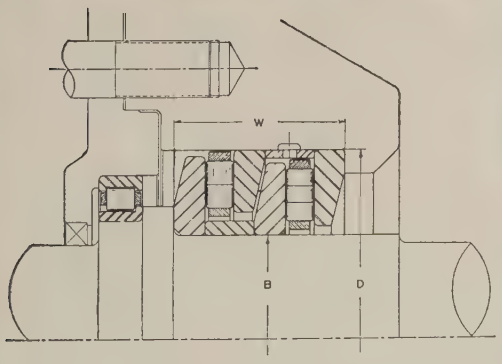
Using axial space along the shaft, rather than enlarging the housing diameter, this new Rollway tandem thrust bearing distributes the load over two or three stages of roller components. Gives 2 to 3 times more thrust capacity than conventional thrust bearings. Life expectancy is 8 to 12 times longer depending upon the number of stages.

Each stage comprises a rotatable bearing plate . . . a bronze retainer with thru-hardened steel rollers . . . a compression sleeve . . . and a stationary bearing plate. The thrust load is applied to the first stage and is by-passed by each compression sleeve in turn to the remaining stage or stages.

Calculated deformation of the bearing plates distributes the load uniformly on all rollers. A greater number of rollers in the first stage carries about 60% of the load, without increasing the load per roller. Compression sleeves have cross-sectional areas proportional to the load imposed. Roller variance is held within one ten-thousandth inch.



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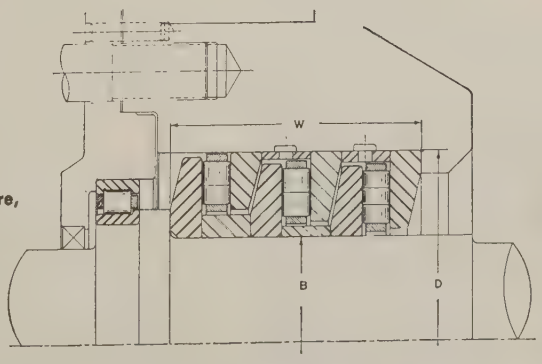
22 sizes, up to 17" bore, 34" O.D., and 2,325,000 lb. capacity at 100 rpm



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Joining and Assembly

J. F. GALBRAITH
Manager, Electric Welding Dept.
Linde Co., division of Union Carbide Corp., Newark, N. J.

of hand-held drill motors, producing substantial reduction in production costs and eliminates secondary reaming or broaching.

New shouldered blind rivets and Huckbolt fasteners are being developed for the honeycomb applications.

This year, we expect to see inroads into highway bridge and industrial building construction. High tensile Huckbolts (5/8 and 3/4 in.) are on the way. One structural application has been completed.

The market for quality fasteners that offer something more than the simple screw or nut and bolt is growing. (We have multiplied output 12 times in eight years.) The answer is adequate research and development facilities.

Small Wire Welding Extends Usefulness of Fusion Method

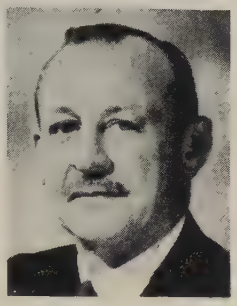
—J. F. GALBRAITH

• Pilot arc spotwelding is a major advance in the fabrication of missile components. It eliminates high frequency for starting, provides a high degree of weld consistency, and improves the weld by its postheating effect.

In one application, it welds stainless steel missile fins in an automated, tape controlled machine. The same principle is used to make high quality manual welds. The process will find wide usage in sheet metal fabrication and honeycomb panels.

Small wire welding (3/64 in. down to 0.015 in.) using the new inert gas, shielded short arc technique is now well established. It works extremely well in all positions on all metals 0.030 in. to

Joining and Assembly



GEORGE A. TINNERMAN
President
George A. Tinnerman Corp.
Cleveland

0.125 in. thick. New welding equipment, power supplies, and techniques will establish welding in areas not previously useful. Outstanding examples: Welding of truck cabs and corner posts on automobiles, air conditioning ducts, furnace parts, tank ejector units for jettison fuel tanks, steel desks, mail bag frames made from light-gage tubing, and stainless steel capacitor cans.

The process has proved itself on stainless, carbon, and galvanized steel. In these areas, it is faster than Heliarc welding and more economical than covered electrodes.

Rising Construction Costs Spur Need for Fasteners

—GEORGE A. TINNERMAN

• Building authorities look for cost increases of about 5 per cent in 1959. Their prediction points up the need for the development of new fasteners and fastening techniques.

Contractors are enthusiastic about fasteners which can be used without any special equipment.

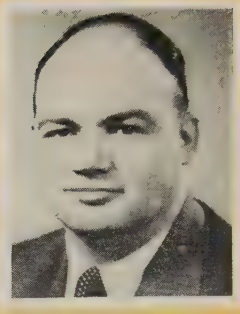
One was introduced last year. It costs less than 18 cents and replaces conventional rod hanger clamps which cost 30 to 56 cents and require two to three times longer to install.

By concentrating on such fasteners and licensing qualified manufacturers to produce them, we can do much to offset the upward cost trend. Seemingly little things like clamps and hangers have influence on costs far out of proportion to their sizes.

H. B. CARPENTER
Senior Engineer, Esso Standard Oil Co., New York

ROBERT F. RICE
Manager, Crane Dept., Whiting Corp. Harvey, Ill.

E. W. FRANZ
Secretary, May-Fran Engineering Inc. Cleveland



ROBERT H. DAVIES
Vice President, Industrial Truck Div., Clark Equipment Co. Battle Creek, Mich.

1959 FORUM ON TECHNICAL PROGRESS

Handling and Packaging

Rust Preventive Emulsions To Gain Popularity in '59

—H. B. CARPENTER

• New emulsifiable petroleum base products will continue to create considerable interest as rust preventives for indoor protection of ferrous metal parts in process or packaged for shipment. They furnish protection equal to that provided by light solvent cutback rust preventives. They also neutralize corrosive fingerprints, leaving a residual film which protects against corrosion during later handling.

Emulsifiable types eliminate the fire hazard which is sometimes associated with solvents. They can be applied by dipping or spraying to surfaces wet with water or emulsified cutting oil. The film is a lubricant in nature; except in unusual cases, it does not have to be removed before the part is put in service. It can be removed easily with a petroleum solvent if necessary.

Conventional soluble oils used in machining and grinding have some rust preventive properties (attempts to improve them have not been particularly successful) but they do provide lasting protection.

Satisfactory performance has been obtained from modified petroleum base rust preventives that form stable emulsions when mixed with water.

Additives inhibit the corrosive action of the water until it evaporates, leaving a protective film.

Some emulsifiable products leave an oily film. Others deposit a semisolid, greaselike film which does not run off or rub off through contact with packaging material.

Both films are thin and transparent; if the film must be seen, a dye can be added to the preventive.

Look for Automatic Cranes, More Accurate Controls

—ROBERT F. RICE

• Accurate, automatic control systems will be used on more overhead traveling cranes in the next few years, especially where extreme accuracy is required.

Progressive manufacturers are looking for more ways to reduce the cost of material handling. In any manufacturing process that includes a repetitive route or motion, costs can be cut with an automatic crane, releasing the crane operator for other work.

Several electrical manufacturers have recently announced improved crane controls. Example: Hoist motor types that cause the motor to produce the required torque and speed without electrical or mechanical retarding brakes.

Expansion in Material Handling Facilities Forecast

—E. W. FRANZ

• More companies are expected to make changes in material handling methods in 1959. As building costs continue to rise, it becomes imperative that every square foot of production, assembly, and storage area be used to advantage. Plant expansions are often unnecessary if the proper production and handling tools are applied in present plants.

In 1958, we all learned where and how to cut the "fat" from overhead. Management has come to appreciate what efficient material handling can do in cutting product costs.

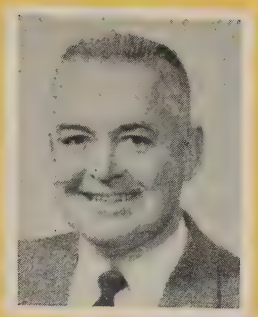
While expenditures for capital expansion were curtailed in 1958, material handling systems should receive increased attention this year.

Leasing of Shop Trucks Will Be Popular This Year

—ROBERT H. DAVIES

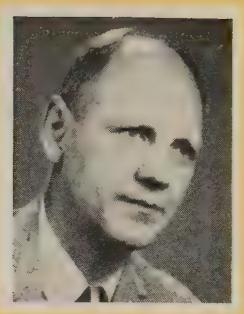
• "How shall we buy?" not "Where shall we buy?" will be the question asked by many users of material handling equipment this year. There will be sharpened interest in leasing, rental, and other techniques for spreading the investment dollar. Dollars will be available for capital

LESTER M. SEARS
Chairman, Towmotor Corp.
Cleveland



FRED L. HOOPER
Executive Vice President
Cambridge Wire Cloth Co.
Cambridge, Md.

LIVINGSTON KEPLINGER
President, Steel Shipping Container
Institute, New York



WALTER A. GARRETT
Sales Manager, Strapping Div.
Brainard Steel Div., Sharon Steel
Corp., Warren, Ohio

investment, but because of the interruption in capital spending for the past year or more, modernization requirements will compete with expansion plans for each dollar available.

In the metalworking field, modernization requires heavy outlays. Leasing and rental plans will provide material handling equipment when it is most needed without the allocation of funds needed elsewhere.

Leasing will appeal mainly to the larger companies—those needing sizable quantities of handling equipment. For such firms, the biggest advantage of leasing is that it makes equipment available without excessive use of credit or large outlay of capital.

Rental plans will be more popular with smaller shops, where handling requirements vary with production and equipment is fully utilized only during peak periods. By renting fork trucks, these shops will have the equipment when it is needed but will not have the expense of long term ownership.

Continuing a trend that started last year, versatility will be a key factor in the selection of handling equipment whether it is bought, leased, or rented.

Refinements in Lift Trucks To Increase Their Scope

—LESTER M. SEARS

• Developments this year will extend the usefulness of lift trucks in all departments. Extra attention will be given advances which simplify material handling operations, and move more products through the plant, off the docks, and out of the yard. Management will also consider how lower servicing costs and reduced downtime resulting from minimum maintenance attention can contribute to profits.

We expect greater use of special load handling accessories, power steering, automatic drives, and other features that can reduce handling costs.

Our company, convinced that special features will be in demand, is introducing a number of new lift truck features, including a pedal operated power control. It enables operators to move lift trucks forward and backward more swiftly and smoothly with the left foot on a pedal. Hands are free for easy steering and faster lift operation.

It eliminates gearshift, clutch, transmission, drive line, and differential, the major causes of costly maintenance.

Conveyors for the Sixties Must Resist Heat, Chemicals

—FRED L. HOOPER

• The usefulness of woven wire belting will be increased in the sixties by metal mesh belts impregnated with high temperature silicone materials, rubber and plastic belting reinforced or cored with steel mesh, and metallic belts suited for troughing.

Cermets will open new fields for metal mesh belting for use at temperatures exceeding 2100° F. New alloys are already being field tested. Some will be offered this year.

Some plants are now planning full automation to capitalize on the demands of the sixties.

Obsolescence stands in the way of low unit costs; products must move "to, through, and from" processing equipment on conveyors which are resistant to chemicals and heat.

Lighter Gage Steel Will Be Used in Shipping Containers

—LIVINGSTON KEPLINGER

• The trend in steel shipping containers is toward lighter gages of steel (20 and lighter). Cold-rolled sheets with minimum scale and other excellent physical properties aid the surface treatment and coating of container exteriors and interiors.

Light gages also play a prominent part in the economics of container sales, where fiber, plastic, and other materials less expensive than steel are offering stiff competition, particularly for dry products.

Lighter gages permit the reduction of container selling prices and trim freight charges for the shipper.

This year will see increased use of the 20/18 gage drum (20 gage sides, 18 gage top and bottom).

In the ensuing decade, liquids and dry products will probably be carried in 24 or 24/26 gage drums.

Because of the durability and excellent quality of new steel drums, the lighter gage types are being reconditioned and re-used.

Smaller containers are already being made in the lighter gages.

Automatic Equipment To Be Used for Strapping

—WALTER A. GARRETT

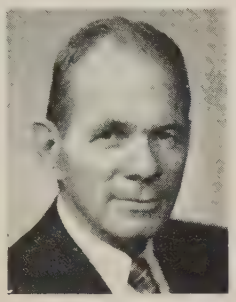
• We believe that 1959 is a kickoff year for a decade of good times and progress. Prosperity means the exchange of goods, so strapping will be in great demand. In addition to the improvement of products, substantial changes in the way they are packaged for end use are due.

The greatest contribution to more efficient, less expensive handling and packaging has been the development of power tools, especially portable types.

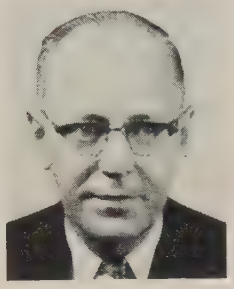
More new and unusual tools will help reduce the time and effort involved in packaging.

Automation is making headway in the strapping industry. Automatic tools, with automatic handling equipment bringing materials to and from the strapping stations, will find increased use. Strapping

Handling and Packaging



HOWARD M. PALMER
Vice President & General Sales Mgr.
Lewis-Shepard Products Inc.
Watertown, Mass.



JOE H. PERITZ
Executive Secretary, Electric
Overhead Crane Institute Inc.
Washington

W. A. MEDDICK
President & General Manager
Elwell-Parker Electric Co.
Cleveland

R. C. SOLLENBERGER
Executive Vice President, Conveyor
Equipment Manufacturers Assn.
Washington

will continue to reduce costs and make packaged products safer to handle.

Efficiency, Economy Keynote Material Handling This Year

—HOWARD M. PALMER

• The growth of the material handling supervisor to a management level indicates recognition of handling equipment as an effective cost cutting tool.

Cost cutting and helping the businessman make more profits have always been the basic sales appeals of material handling equipment.

To satisfy the needs of an economy minded industry, the material handling manufacturer must offer:

1. A complete line of equipment, designed to cut handling costs.
2. Special attachments to make standard trucks more versatile.
3. Job engineered equipment for volume production work.
4. Trained sales engineers who know how to trim costs and apply equipment.

Those factors are a definite challenge to manufacturers of material handling equipment; they are naturally efficiency minded. They will continue to offer new products and techniques to the cost conscious buyer.

Cranemakers Look for Modest Uptrend in '59

—JOE H. PERITZ

• The anticipated need for greater industrial capacity in coming years has not been overstated.

Crane manufacturers don't feel that 1959 will be a boom year, but they do not anticipate a continuation of the present business drought. They believe 1959 will be 25 to 30 per cent ahead of 1958.

Throughout industry, increasing costs and the consequent squeeze on profits will compel the appraisal and reappraisal of procedures, processes, equipment, and facilities. The answer to the cost problem will vary in different companies and industries. In some cases, equipment can be modernized. In some cases, equipment replacement will allow fullest use of more modern tools. In other cases, completely new plants will be required.

Crane manufacturers will tailor their designs to take advantage of advances in electronics, plastics, and metallurgy that are technically and economically sound. Greater speeds, greater capacity, more automated processes, and more exact hook control will lead the way.

Industrial Truck Market Is Year Away from Boom

—W. A. MEDDICK

• Manufacturers of industrial trucks and other capital equipment can expect no more than a 15 per cent increase in business this year. Reason: The time lag between the appropriation of funds and the delivery of equipment.

Any large scale capital equipment appropriation must come from new plants or major plant additions and will not be made before the spring of 1959. Because of the engineering and production time needed for most capital equipment, there must be a delay of about 11 months from order date to delivery date.

The so-called boom in capital equipment will not come until 1960. The expected 15 per cent gain in capital equipment will come from the gradual replacement of equipment.

There will be greater demand for large capacity industrial trucks, particularly in the metalworking industry.

More companies will buy steel in coils instead of sheets to reduce scrap and shearing losses. Larger trucks (capacities of 16,000 to 20,000 lb) will be required to handle the larger loads.

Steel producers are using trucks with capacities that average 30,000 lb. Larger trucks, handling larger coils, will cut their handling costs appreciably.

Conveyor Industry Must Adapt To Changing Times

—R. C. SOLLENBERGER

• "Threshold Year," is an especially apt description for 1959. In 50 years, technology has progressed through the horse and buggy, the auto, the airplane, the radio, and television ages to the rocket age. Sober-minded engineers and businessmen are talking in terms of the science fiction writer of only a few years ago.

This year will see technological breakthroughs in almost any branch of science or engineering you can name. New industries will come into being in the next decade; old industries will die if they don't adapt to changing products and markets.

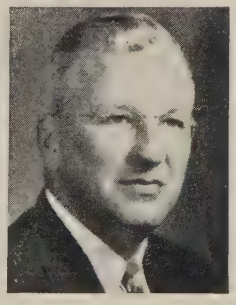
This year, a wave of technological obsolescence for machines and materials may begin. Technological obsolescence is no stranger to the conveyor manufacturer; he has seen many ingenious conveyor systems made obsolete long before their useful lives were ended simply because of a change in product, or the disappearance of a market.

There probably won't be any startling developments or new principles in conveyors, but the trend is toward greater refinement of components, more and better safety features, and more standardization of components, structures, and terminology.

Prefabricated, sectionalized construction, now found in several types of conveyors

Handling and Packaging

EDWARD W. McCAUL
Vice President, Sales, Jervis B. Webb Co., Detroit



O. H. McCLEARY
President, Mathews Conveyer Co. Ellwood City, Pa.

JOHN H. MORAVA
President, United States Steel Supply Div., U. S. Steel Corp. Chicago

used for bulk and unit handling, will be used more in 1959 and in the future.

More automated systems will be built for manufacturing and distribution. Conveyors with automatic controls will lead to and from automated machines and storage areas. More effective safety devices will protect the operator, product, and machine.

Built-in inspection devices will maintain quality while work in process is on the move. Radioactive materials and the techniques of using them will make possible more accurate quality control for many kinds of products.

Long-haul transportation of materials and the short-haul of passengers by conveyors are areas likely to expand. Moving walks, operating on the level or up to 15 degrees have proved their worth in ending pedestrian congestion and eliminating physical effort.

Conveyors To Find Wider Use In Age of Automation

—EDWARD W. McCAUL

• The conveyor industry is anticipating ever broadening markets.

In the industries where conveyors have long been used, such as the automotive and household utilities fields, new areas are developing. Greater use of automatic loading and unloading is foreseen. Automatic dispatching and pushbutton warehousing will be used more in the storage and feeding of parts to assembly lines.

In industries not mechanized, methods of adapting the continuous flow principle are being studied. In the next few years conveyors will be used more in those industries, particularly in the handling of parcels, mail, freight, and baggage. They will be used most in automatic sorting and distribution of freight for the truck and express lines, in handling mail for the government, and in handling baggage for the common carriers.

Greater use of truck, train, boat, and airplane borne conveyors is being considered. Some trucks are already equipped with conveyors for special commodities. The Boeing 707 is equipped with baggage conveyors.

Light metals and high tensile steels will find greater use. The trend toward automation will promote the use of electronic and magnetic memory devices in conveyor systems.

Special Conveyor Systems To Get Greater Use in '59

—O. H. McCLEARY

• The conveyor industry should have the benefit of a favorable business climate this year. Expenditures for capital equipment, conveyor systems included, should increase in metal producing and metalworking plants.

We expect increasing demand for automatic features in conveying equipment. The great emphasis on cutting costs will certainly carry over into this period of better business. Automation, or processes approaching it, should be applied more generally.

For those companies in the business of developing and manufacturing engineered conveying systems for the metalworking industries, the trend toward automation has real significance.

There will be stronger emphasis, especially in the larger plants, on a continuous flow of materials in process. Manufacturers of engineered conveying systems will be called on to design and build equipment to handle materials in process or finished materials faster and in greater volume than ever before. As processing machines are operated faster and as they include more automatic features, there will be greater demand for special conveyor systems to handle materials in an uninterrupted flow.

The demand for engineered conveyor systems will increase with the trend toward automation.

As more modern production machinery is used in metalwoking plants, the conveying machinery which keeps it supplied become more important.

While there will be less emphasis on automation and automatic control in the smaller metalworking plants, mechanized handling will also get its share of attention there.

The smaller manufacturer also must develop a continuous flow of his products. He can no longer afford manual handling and the general confusion inherent in a nonmechanized plant.

Powered Strapping Equipment To Gain in Popularity

—JOHN H. MORAVA

• This year, more emphasis will be placed on efficiency, the development of more custom-built equipment, and improved strapping materials.

The steel strapping industry has come a long way since the days of the hand-nailed metal strip. Mechanized tensioning and sealing, then powered strapping tools, were developed to offset increased packaging costs. The last two years focused even greater attention on cost reduction.

Many powered, labor-saving machines were introduced in 1957-58. More will be developed. Demands for better manually operated equipment will increase.

Stronger and lighter strapping materials, in both round and flat forms, have reduced packaging costs considerably in recent years. More strength-weight gains are expected.

A wider variety of coating materials will offer greater protection for the strapping. It will be easier to handle and apply, and discoloration of package contents from corrosion will be eliminated.

New methods and equipment will take much of the guesswork out of strapping operations.

Improvements will be made on the friction or deformed type seal; joints made by those methods develop 95 to 100 per cent of the strapping material strength.

Among the new developments in strap-

PLYMOUTH® LOCOMOTIVES with Torqomotive Drive

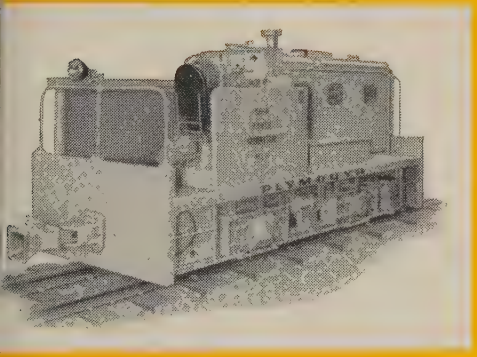
3 TO 80 TONS

Industry's Smoothest Switchers

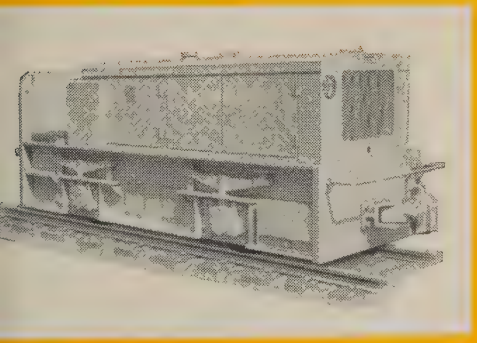
Here's the lineup of well-known Plymouth power in models from 3 to 80 tons . . . narrow or standard gauge . . . Gasoline or Diesel . . . mechanical or Torqomotive Drive . . . Diesel-Electrics. Records of users show Plymouth's economy, efficiency, dependability. Find out how these profit characteristics can improve your operation and cut costs.

PLYMOUTH LOCOMOTIVE WORKS
Division of The Fate-Root-Heath Company
Dept. A-1, Plymouth, Ohio

SINCE 1914 Plymouth Locomotives have been used for heavy hauling and switching jobs. They have proven themselves in year after year service with rock bottom economy, maximum availability, minimum down time. Pictured above is the new WDT Cab-in-front model, 40 tons, in service hauling pulpwood. Both the MDT and WDT are available in this model or in the standard models shown below.

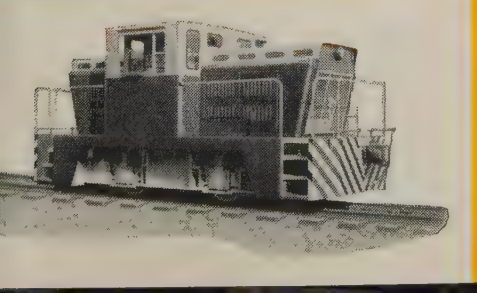


J SERIES Mine-O-Motive, 15 to 25 tons. Diesel powered with exhaust conditioner, Torqomotive Drive. Approved under Schedule #24.

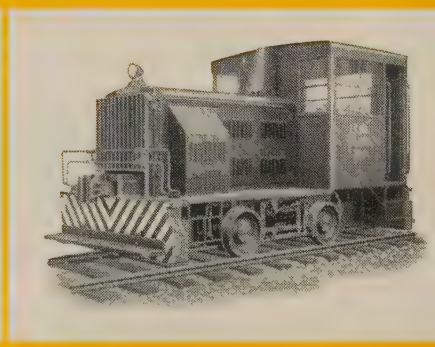


DMS SERIES Mine-O-Motive, 8, 10 or 12 tons. Diesel powered with shaft drive to both axles, full power shifting. Approved under Schedule #24.

CR SERIES, 40 to 60 tons. Diesel powered with shaft drive to both axles, full power shifting, Torqomotive Drive. Speeds to 35 MPH.

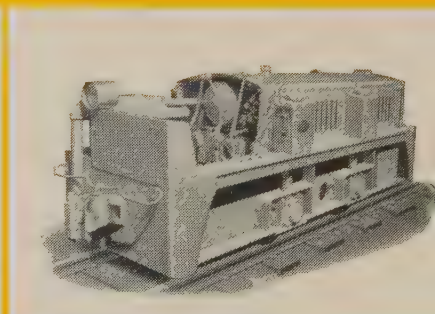


M SERIES, 25, 30, 35 or 40 tons, Diesel or gasoline, mechanical or Torqomotive Drive. This is the standard model, rear cab.

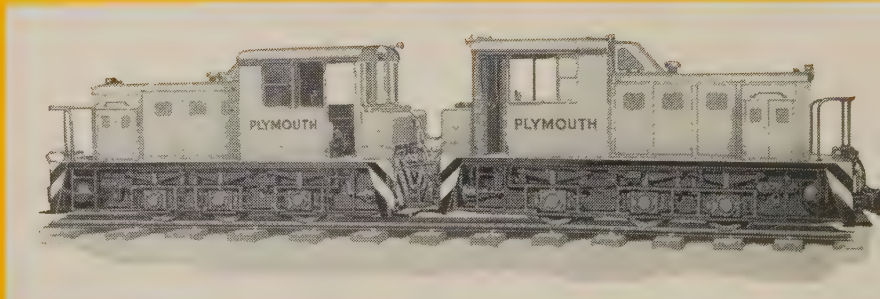


J SERIES, 12, 14, 16, 18 or 20 tons, Diesel or gasoline, mechanical or Torqomotive Drive. Available on 4 or 6 wheels.

D SERIES, 8, 10 or 12 tons, Diesel or gasoline, mechanical or Torqomotive Drive. Cast or Welded Frame.



F SERIES, 5, 6, or 7 tons, available as mine type (illustrated) or cab type. Torqomotive Drive, short wheelbase.



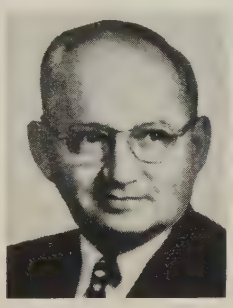
PLYMOUTH TANDEMS—M or W Series 50 to 80 tons. The M or W Series can be built for tandem, single control operation, up to 80 tons on either 8 or 12 wheels. Each locomotive can also be operated individually.

**Torqomotive Drive;* Plymouth transmission coupled to hydraulic torque-converter.

PLYMOUTH® LOCOMOTIVES

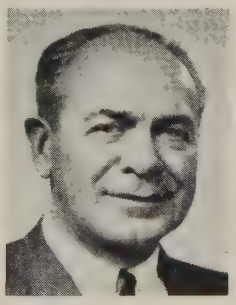
PLYMOUTH LOCOMOTIVE WORKS

Handling and Packaging



W. SHERIDAN HUSS
President, Acme Steel Products Div.
Acme Steel Co., Chicago

L. WEST SHEA
Managing Director, Material Handling
Institute Inc., Pittsburgh



ELMER F. TWYMAN
Vice President, Yale & Towne
Mfg. Co., New York

ping tools is an improved torque handling stretcher which permits more accurate tensioning.

More Mechanization in Packaging Expected in '59

—W. SHERIDAN HUSS

• With increased interest in cost reduction, manufacturers of machines for material handling and packaging must develop more automatic equipment.

For instance, in the steel strapping industry, the trend is toward automatic units which can be adapted and customized to any company's packaging and shipping requirements. Automatic steel strapping equipment is being developed for integration with other equipment in an efficient production line operation.

Manufacturers are adding accessory units to their standard steel strapping equipment. They are faster, easier to operate, safer to use, require less effort, and reduce fatigue.

This year, management should see more clearly the opportunities to reduce costs and increase profits through the use of specialized services in handling and packaging.

The material handling and packaging manufacturers are continually developing new methods in unitizing products for safe shipment.

Mechanization and automation are being used more in the handling of products from production line to ultimate use.

Advances are being made in the packaging, shipping, receiving, and storing of products in the lumber industry, the primary and fabricated metal industries, and in the brick, tile, and clay products industries. Those industries have become more aware of the need for cost reduction in material handling and packaging.

Better Material Handling To Cuts Costs This Year

—L. WEST SHEA

• Fully integrated material handling systems will be more widely adopted by industry in 1959 than ever before. They will have an emphatic impact on operating costs, the expediting of production, and gross profits.

In the last five years, more attention has been focused on handling. It is one of the few remaining places where costs can be cut.

Management is beginning to see that an occasional increase in material handling costs can increase production and lower over-all costs.

The purchase of new and the reassignment of older equipment reflect greater interest than ever before in equipment application.

In 1959, there will be more emphasis on mechanization and the use of the right material handling tool in the right application.

This year will see the introduction of several developments in material handling equipment to do specialized jobs.

Our segment of the metalworking industry should see an increase in business this year.

Material handling is taking a more important place in the industrial world. Many men with specialized training in material handling are in responsible positions in the metalworking industries; more than 200 people are teaching material handling courses in colleges and extension schools.

Directed education in material handling will benefit all American industry.

New Features Make Lift Trucks Special Purpose Vehicles

—ELMER F. TWYMAN

• The full impact of recovery from the recession will be felt during the first quarter of 1959 when industry will underwrite new capital expansion programs.

Planning for 1959 is decidedly bullish; there is widespread confidence that the year is the threshold of the "soaring sixties," a decade in which the most monumental expansion in our economic history is expected. Such confidence is found not only in the U. S. but also in the rest of the world.

All expansion plans include wider use of fork lift trucks as key tools, both in expanded production and distribution. For 1959, the trend will be to design and produce fork lift trucks with greater lifting and lowering speeds, greater maneuverability. Power steering and automatic transmission are being used more as standard equipment. Increased use of special attachments will transform the standard fork lift truck into a special purpose vehicle.

Development of special attachments is stimulated by new packaging methods and new shipping techniques. Also, there is a growing trend toward containerization and palletized loads.

The fork lift truck is gaining acceptance abroad as a fundamental tool for expanded industrialization. The principal deterrent to greater exports is the lack of foreign capital.

Even that obstacle is being overcome by companies realizing that the right handling equipment must be used to get the most out of rolling stock and cargo vessels.

There is growing awareness abroad that internal transport must be as efficient as high speed production equipment.

As packaging, shipping, and warehousing techniques are improved, special purpose trucks will be designed to fit new jobs. In outdoor applications, lift trucks will replace manual handling wherever possible.

High capacity, pneumatic tired vehicles will use special attachments to adapt them to logging, manufacturing, and farming.

KERRY L. BERKEY
Senior Project Engineer
Wright Air Development Center
Wright-Patterson Air Force Base
Dayton, Ohio

W. J. BROWN
Staff Production Applications Engineer, Gulf Research & Development Co., Gulf Oil Corp.
Pittsburgh

ALEX P. FOX
Vice President
Lincoln Engineering Co.
St. Louis

E. L. H. BASTIAN
Senior Engineer, Manufacturing
Shell Oil Co.
New York

1959 FORUM ON TECHNICAL PROGRESS

Lubrication

High Temperature Lubricants Needed for Aircraft Engines

—KERRY L. BERKEY

• Aircraft engines will operate at still higher temperatures because of higher flight speeds and greater heat rejection rates.

Use of air as a heat sink for oil cooling is no longer practicable because of the high temperature of ram air at high flight speeds.

Lubricants and engine parts, such as gears, bearings, and pumps must be operated at ever higher temperatures. High temperature gear materials and lubricants will be needed to retard wear and extend operating life.

In gas turbines, gear loads will not increase drastically, but the operating temperatures of gears and lubricants will be higher. A 35 per cent increase is expected in the near future, possibly 100 to 200 per cent in the next few years.

Use of Soluble Roll Coolants In Cold Rolling To Increase

—W. J. BROWN

• Soluble oils for cold rolling ferrous and nonferrous metals will meet wide acceptance in 1959. Water soluble compounds, with their excellent cleaning, wetting, and burn-off characteristics, will permit higher mill speeds and lower rolling temperatures. They also provide good rust protection and closer tolerances.

When strip is cold rolled with soluble oil, it does not require cleaning before it is annealed.

Improved soluble and mineral rolling oils will be offered for aluminum, titanium, and other metals, permitting higher rolling speeds and providing better reduction.

In the development of new lubricants and coolants, attention will be given to the role of oils in producing better rolled finishes. Water marking, heretofore an objectionable feature of soluble oils, will be eliminated; more effective rust preventives will be offered for steel and its alloys.

Centralized Lubrication To See Greater Use in '59

—ALEX P. FOX

• Improved lubrication methods will increase machine performance qualitatively and quantitatively this year.

Plant managers are trying harder than ever before to reduce operating costs. Taking a long, hard look at growing investments in production facilities, they are insisting on more effective methods for increasing dividends. In looking for ways to cut costs and increase production, they have discovered a gold mine in the modern, centralized, power lubrication system.

For many years, manual lubrication was adequate because bearings weren't the jewellike assemblies they are today, and machinery didn't move rapidly. Casual, even careless lubrication was often good enough. But failure to give modern, high speed bearings and machines their exact lubrication needs is the same as committing sabotage.

Centralized lubrication systems will insure longer machine service life. They will eliminate the human element, positively protect against breakdowns caused by inadequate lubrication, and reduce over-all maintenance costs.

They will expand the sales appeal of new equipment, and provide long, uninterrupted service life with a minimum expenditure for lubrication maintenance and part replacement.

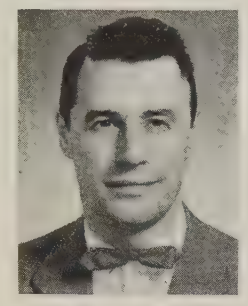
Modern Metals Will Require Improved Lubrication Methods

—E. L. H. BASTIAN

• There must be continued improvement of lubricants for new or conventional metal fabrication methods.

Alloys being used in the aircraft and missile fields are refractory and often

Lubrication



H. A. HARTUNG
Research & Development Dept.
Applications Research Div.
Atlantic Refining Co.
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BRUCE M. DUNHAM
Technical Consultant
Sun Oil Co.
Philadelphia

J. M. DAVIDSON
Sales Manager
Metal Processing Dept.
Pennsalt Chemicals Corp.
Philadelphia

R. Q. SHARPE
Chief Engineer
Industrial Div.
Socony Mobil Oil Co.
New York

reactive. Including such elements as titanium, tantalum, and molybdenum, they are designed for operation at temperatures up to 2000° F.

With new extrusion processes derived from older spinning methods, surface reactive metals will be fabricated without the metal-gas reactions found in hot working because the metals are worked below their recrystallization temperatures.

There will be continued use of the three general types of metalworking lubricants—emulsions, mineral oils, and solids.

Water base lubricants, used primarily as coolants, consist of solution and dispersion fluids. The oil-type fluids, including several extreme pressure and friction reducing compounds, are used in the newer forming, drawing, and extrusion processes.

Solid lubricants, including certain metals, graphite materials, and soaps, will gain popularity in metalworking. They will be used more where high surface adherence and high spot temperatures are encountered.

Reactive metals are often clad with another metal, such as copper or aluminum, before extrusion. The cladding can be retained during secondary working. The soft copper or aluminum sheath serves as a solid lubricant and as a substrate for application of fluid lubricants.

High Temperature Lubricants Will Gain This Year

—H. A. HARTUNG

• Designers, builders, and operators of industrial equipment are becoming more aware of the need for high quality lubricants.

Modern equipment in the metalworking industry is capable of high speed production; metalworking lubricants and rust preventives are receiving more attention. Increased emphasis on lubrication and the growing demand for higher quality products will stimulate suppliers to produce better lubricants.

In many new machines, higher operating temperatures and pressures are being encountered. Those developments will make necessary industrial lubricants with excellent stability and lubricating properties.

In some cases fire-resistant lubricants will be required; they will gain popularity in the coming year and the decade to follow.

Trend Favors Fire Resistant, Heat Resistant Lubricants

—BRUCE M. DUNHAM

• This year, more attention will be directed toward fire-resistant fluids in industrial plants. Fire-resistant fluids will be used more in hydraulic systems of mining equipment. Water-in-oil emulsions will be widely adopted because of their low initial cost.

The wide variety of lubricating oils now available will be satisfactory for general industrial use. Industry is not demanding many new functions in lubricants to accommodate present or near future machine designs.

Newer metal processing equipment will continue to use less grease per ton produced. Demand for greater production will spur development of better heat resistant greases. Another trend will be the increased use of heat resistant, water resistant, "extreme pressure" greases.

No revolutionary thickener or gelling agents appear on the horizon. Calcium, sodium, lithium, and calcium-complex type thickeners, along with present inert gelling agents, will be most popular.

Improvement in petroleum base rolling oils for carbon steels, stainless steels, aluminum, and brass may be expected in 1959; they are expected to produce cleaner metal with brighter finishes.

Wire To Be Phosphatized In Continuous Process

—J. M. DAVIDSON

• For some time, the wire industry has been interested in a process for the continuous phosphatizing of wire prior to drawing or forming. It is adaptable to automation. At present, batches of wire are phosphatized in coils for about 5 minutes. Continuous application requires less space, less handling equipment, and less labor. It also improves uniformity of coatings. Scalefree wire may be phosphatized in from 1 to 5 seconds by a special, two stage chemical process.

In 1959, the process should be accepted on a production basis. Test runs were made on low carbon 0.25 in. wire that was descaled mechanically prior to the phosphatizing process. A soap type lubricant was picked up by the wire as it went through the first or ripper die.

The process will save time, cost less, and produce a more standard product than previous methods.

Lubricants Will Keep Up With Changing Technology

—R. Q. SHARPE

• In looking to 1959 as a "threshold year," the designers of metalworking and metal processing equipment can be sure that improved lubricants will be available to meet their needs in new applications.

New technological developments will

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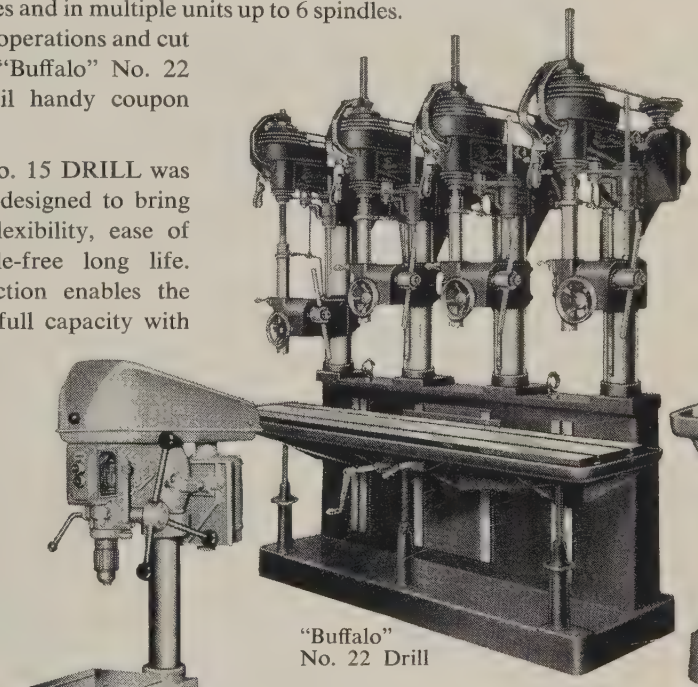

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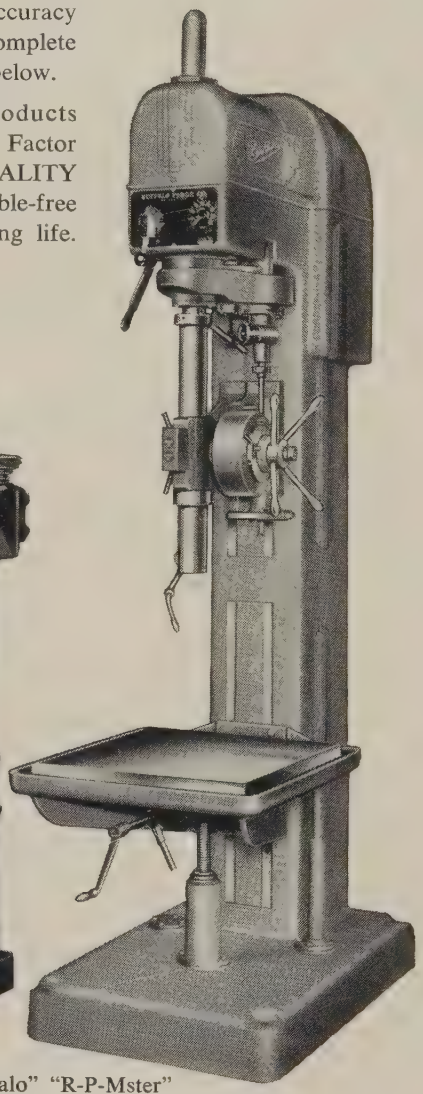

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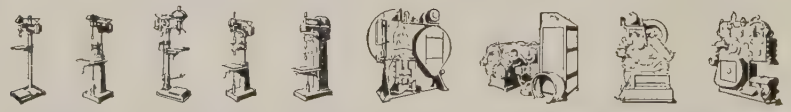

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influence the design of equipment and the lubricants to protect it. Nuclear power will be used more for stationary, marine, and perhaps mobile service. Oils and greases must be relatively unaffected by exposure to radiation. They must retain desirable lubricating properties under severe conditions.

Free piston engines and gas turbines will be used more for power generation. Both will present critical lubrication problems.

In the development of lubricants and metal processing oils, there will be increased use of radioactive techniques in wear measurement. They will offer excellent and reproducible data in minutes or hours, compared with the weeks or months required by other testing procedures.

Modifications in gear design, providing increasing pressure angles and heavier unit loadings, will require improved lubricants. Lubricants are being developed for more effective run-in of new gear sets in large marine and stationary installations.

Synthetics will be used more for fire resistant hydraulic and lubrication service. They will also find increased use where high temperatures and nuclear radiation are encountered.

Solid Films Lubricate At High Temperatures

—RALPH E. CRUMP

• The solid film lubricant industry offers the only products available for temperatures above 600° F. It is using the latest resins and ceramics, synthesizing new solid lubricant pigments, and developing new metal pretreatments to improve adhesion.

In the next few years, solid film lubricants will be beneficial in several areas, including cryogenics, high vacuum technology, and high temperature metalworking.

New rocket, jet engine, and missile designs call for something better than conventional solid film lubricants: Thermosetting resins, usually binding molybdenum disulfide and graphite. There have been demands for increased corrosion resistance in the presence of corrosive substances other than water and performance at extremely low temperatures (−300° F) or extremely high temperatures (1500° F). Positive lubrication is required in ultrahigh vacuums—satellite chambers operating at an altitude of 500 miles where conventional resin bond solid film lubricants would sublime at a prohibitive rate.

The solid film lubricant industry has responded with new corrosion resistant lubricating films; some are good enough to replace cadmium plating. High temperature requirements are met by ceramic bonded solid lubricants, such as synthetic graphite, lead oxide, tungsten disulphide, boron nitride, and other materials unheard of beyond the laboratory two years ago.

Some interesting developments: A high altitude, high vacuum lubricant, in which a ceramic binder replaced the conventional resin binder—molybdenum disulfide was used as the solid lubricant; an abrasion resistant, rubber bonded solid lubricant film for applications where rubber is in contact with metal or other surfaces; and solid film lubricants with known, controlled electrical conductivity properties.

High Temperature Lubricants, Scale Preventives Needed

—ARTHUR J. STOCK

• In the production of missiles and other new metal products, there is a critical need for metals and superalloys with good high temperature properties. This year we must have materials that can stand temperatures not dreamed of five years ago.

Lubricants used in forming the newer alloys continue to be a problem. Graphite has been used for some time as a heat resistant lubricant, but now there is a need for coatings that will prevent oxidation and scale development in the metal being worked. The use of inert atmospheres is a relatively difficult and expensive way to prevent scale development, but it will be used more in the future.

Glass dispersions will be applied to metals before they are soaked, so that scale will not interfere with forming. Aqueous graphite die coatings will be used with the glass materials to furnish lubrication and prevent oxidation.

Boron nitride, tungsten disulfide, and other lubricating solids relatively unknown now will be used more at higher drawing, forging, and extruding temperatures.

Improved Tool Lubricants Must Be Developed in '59

—JOHN A. BOYD

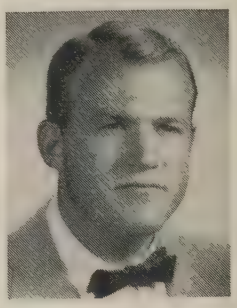
• New alloys and more demanding uses of older ones will start a new development cycle in tool lubrication this year. Engineering changes in missile, satellite, automotive, and allied fields will bring out new metal uses and make sharp changes in tool lubricants.

In the aircraft field, new high strength, thermal resistant alloys will present difficult machining and finishing problems. Standard sulfurized cutting oils will be replaced by modern chemical lubricants that provide better cooling for the tools and better extreme pressure lubrication. With the newer lubricants, the newer alloys can be handled at economical production speeds.

In the automotive field, planned changes in metals will change tool lubricant requirements. Semisynthetic, water soluble compounds will be used more because of their better cleaning and lubricating properties.

Emphasis on reduced machining costs will continue; increased machining speeds will further encourage the shift from straight oils to water soluble cutting compounds. Heavy duty, extreme pressure solubles will make it possible to increase

Lubrication



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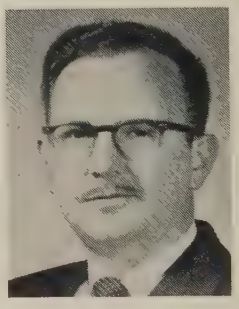

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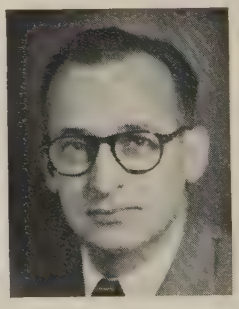
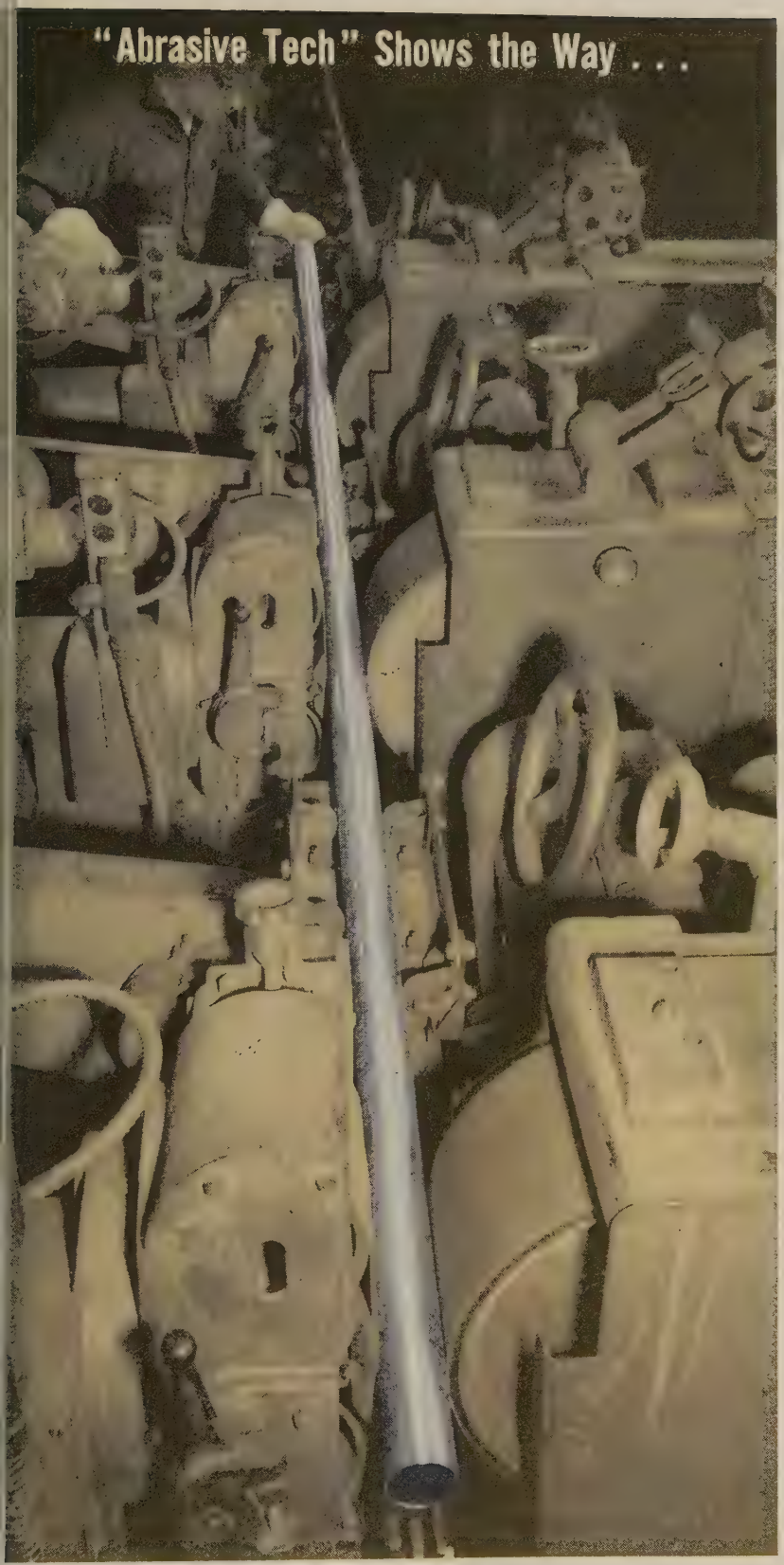
Manager, Research & Development
Acheson Colloids Co.
Port Huron, Mich.



JOHN A. BOYD
Vice President
Van Straaten Chemical Co.
Chicago



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Lubrication

CHARLES E. REED
General Manager
Silicone Products Dept.
Chemical & Metallurgical Div.
General Electric Co.
Waterford, N. Y.

speeds and maintain economical tool life. Long lasting, bacteriafree soluble compounds will find increased use.

Silicone Lubricants To Gain In High Temperature Uses

—CHARLES E. REED

• Improved silicone lubricants will rapidly take their place with other silicone products important in the metalworking industry.

Because of their relatively poor lubricity, silicones have seen little use except where temperature extremes caused other lubricants to fail.

New silicone lubricants will support loads under sliding, rolling, or hydrodynamic conditions, even at extreme temperatures.

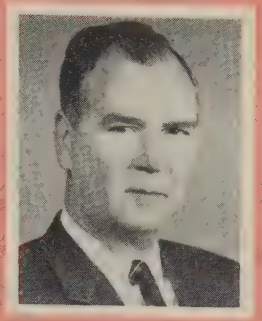
Called Versilubes, they are chemically inert and have extremely high boiling points. Evaporation losses are less than those of any other lubricant. The fluids present no unusual handling problems because they are stable in storage and nonreactive with water.

Among lubricating fluids, they are unmatched in temperature-viscosity characteristics. They pour below −100° F and are pumpable below −65° F. They can be pumped easily at 700° F.

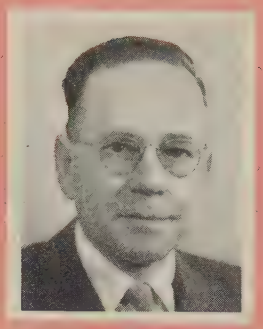
The fluids will meet the needs of the metalworking industry for better high temperature lubricants and hydraulic fluids. They are excellent for such applications as the extrusion, bending, shaping, and high speed drilling of aluminum.

Silicone greases will also offer good lubricity and high temperature stability. Long life at elevated temperatures will reduce the maintenance required on much of the equipment used in the metalworking industry. Bearings in motors, conveyors, rolls, cranes, fans, and other equipment used in high temperature areas will last longer—and they won't have to be lubricated so often.

E. A. CARSEY
Assistant Chief Engineer
Kirk & Blum Mfg. Co.
Cincinnati



WALTER L. DAVIDSON
Manager, General Sales Dept.
Engineering Works Div.
Dravo Corp.,
Pittsburgh



N. T. SHIDELER
Manager, Protective Coatings Research
Pittsburgh Coke & Chemical Co.
Pittsburgh

C. H. GALLAWAY
Vice President
Safety Products Div.
American Optical Co.
Southbridge, Mass.

19 59 FORUM ON TECHNICAL PROGRESS

Service and Maintenance

Predicts Big Advances In Dust, Fume Collection

—E. A. CARSEY

• Industrial dust and fume control systems will play an important role in our industrial lives in 1959. The systems are highly specialized; each application must be engineered to satisfy a specific requirement.

Special coatings will be used more extensively in dust and fume control equipment to protect against abrasion, corrosion, oxidation, and erosion.

Filter and fan designs have been improved. Centrifugal collectors, water spray collectors, cloth and fabric filters, and electrostatic collectors are standard in the industry and will be widely used.

Space Heating Will Get Warm Welcome Even in Mild Areas

—WALTER L. DAVIDSON

• Warm air space heating will find greater acceptance in all parts of the country this year, especially where ventilating, air tempering, or process drying are as important as employee comfort.

For years, the systems have been used to supply warmed air to working areas of large hard-to-heat industrial buildings, warehouses, and commercial structures in the North Central and New England States. They are now finding ready markets in the South, Southwest, and West Coast.

Design changes have led to more efficient combustion and air handling functions. Extreme flexibility in the matching of fan requirements with heater output capacities permits heating engineers to customize heaters for every installation, regardless of geographic location.

Better Pipeline Protection Expected from New Coatings

—N. T. SHIDELER

• In the next two or three years, more will be known about the effect of bacteria on coatings. The definition of the ideal coating system for protection of underground transportation lines may be changed radically.

The study of bacteria may explain why some coating systems fail. It may redirect the approach to coatings for the protection of underground pipelines.

Soil bacteria may do more than cause corrosion of bare steel; there is evidence that bacteria feed on some of the protective coatings, destroying the protective film.

Each year, tons of steel go into underground piping, such as the crosscountry oil and gas transportation lines. For more than 50 years, the most popular coatings used to protect underground piping have been the hot applied coal tar enamels and, to a limited extent, the hot applied asphalt coatings.

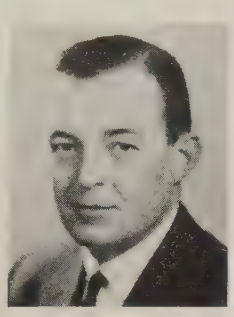
Since 1945, the building of oil and gas transportation lines has accelerated. There has been increased effort to produce a coating that can be applied without heat. New materials, like vinyl and polyethylene tape, have been placed on the market, and considerable interest has been shown in catalytic setting, coal tar-epoxy resin coatings. They are not in general use, but industry is looking in their direction for improvement and simplification of pipeline coatings.

Improved Safety Equipment Needed To Reduce Hazards

—C. H. GALLAWAY

• The future holds many interesting challenges for us. We are faced with hazards resulting from scientific progress, such as those encountered at extreme altitudes or in outer space. A major problem is the utilization of new materials, primarily metals, that may have to withstand extreme temperatures, have superior strength, and be corrosion resistant. New materials will mean new production methods and

Service and Maintenance



JAMES D. WILCOCK
Manager of Marketing
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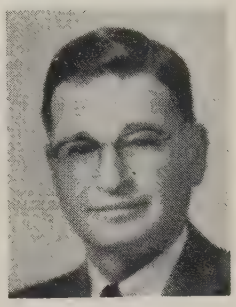
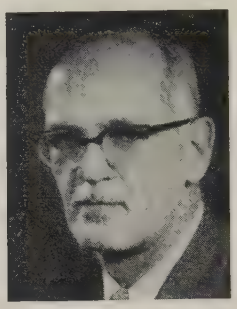
Westinghouse Electric Corp.
Boston

J. T. RYAN JR.
President
Mine Safety Appliance Co.
Pittsburgh



R. T. PRING
Technical Director
Dust & Fume Control Div.
Wheelabrator Corp.
Mishawaka, Ind.



EVERETT P. PARTRIDGE
Director, Hall Laboratories Div.
Hagan Chemicals & Controls Inc.
Pittsburgh

new hazards to personnel. The hazards must be overcome by new or modified safety devices.

Jet aircraft and missiles have created a severe noise problem. Our company sells a good noise protector but is constantly striving to improve it by better design and by the use of new materials.

Plastics and lightweight metals continue to play a leading role in new product development. We are experimenting constantly with those materials, to offer industry a safer, more durable product.

One of the products resulting from our development program is a respirator used by workers in areas where heat (up to 300° F) harms the respiratory system and limits worker productivity. The respirator, used to cool air to respirable temperatures, is made of plastic and aluminum. It is practically weightless but durable.

Progress in Air Conditioning Seen for Next Ten Years

—JAMES W. WILCOCK

• In the next decade, many advances will be made in the design and application of ventilating and air cleaning equipment.

Today's research effort is tomorrow's product. The search for new alloys, better welding methods, complete resistance to erosion and corrosion, high temperature materials, more efficient heat transfer, and better controls will result in new and better air handling products.

There will be more air conditioning and high-efficiency air cleaning in industrial plants. With effective control of temperature and the contaminants in the air, savings can be made in manufacturing efficiency, plant maintenance, and worker well-being.

Research will help the designer decrease the size of his product, saving valuable space and reducing the cost of related equipment, such as ductwork. Research in noise abatement will promote the manufacture of quieter equipment.

Safety Equipment Keeps Pace With Metalworking Progress

—J. T. RYAN JR.

• Rapid progress in the production of quality steels will place increased demands on the makers of safety equipment this year. They must develop new equipment to meet special problems that accompany technical progress in metalworking.

Safety is never off the drawing boards. Safety engineers keep up with new processing techniques; they are constantly engaged in research and development, so that safety devices can be available when new hazards appear.

More automatic instruments will be offered because of the trend toward automation and more effective quality control in making special alloys.

Progress in safety equipment is not confined to automation processes. Other equipment must be kept up to date. Examples: Gas masks, safety helmets, and portable instruments for checking potentially dangerous gas concentrations.

Improved Methods Considered For Air and Gas Cleaning

—R. T. PRING

• Research will continue in 1959 on equipment for cleaning open hearth furnace gases, particularly on high efficiency scrubbers, continuous slag wool filters, and conventional baghouses employing various filter media. Until a less expensive process can be developed, electrostatic precipitators will be used for cleaning open hearth gases.

Most cloth baghouses used for the control of electric steel melting furnace fumes employ Orlon filter bags. When used with a properly installed roof-mounted exhaust hood, they show satisfactory resistance to heat and chemicals.

Glass bags have been considered for fume collection from larger melting furnaces. They are no panacea in cleaning arc furnace gases, but in some cases higher operating costs are justified (use of glass at temperatures up to 500° F eliminates the need for gas cooling).

Direct shell tap ventilation is now used in the manufacture of open hearth grade steel. The process is being considered for furnaces melting stainless and high alloy steel.

Interest is being shown in equipment to clean air for rolling mill motorrooms, electrical equipment, and turboblower intakes. Maintenance costs of such equipment are being studied.

Solution to Water Problems Seen in New Coagulant Aids

—EVERETT P. PARTRIDGE

• New coagulant aids promise better water clarification for the steel industry. Iron and aluminum salts alone are no longer effective enough to meet higher standards for treatment—whether the water is re-used or merely disposed of.

Coagulant aids are often mentioned when operators talk about mill waste; solid particles suspended in water pose big problems. Water used in the steel industry for quenching and descaling may require removal of silt or waste products from upstream plants.

Clarification of water after use in many processes is a must for protection

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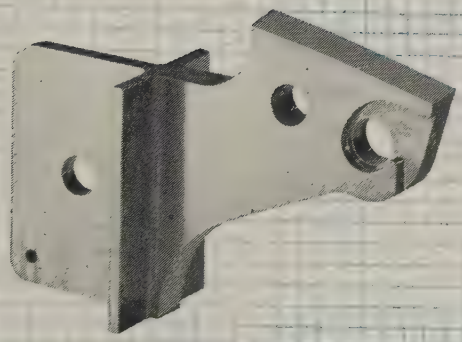

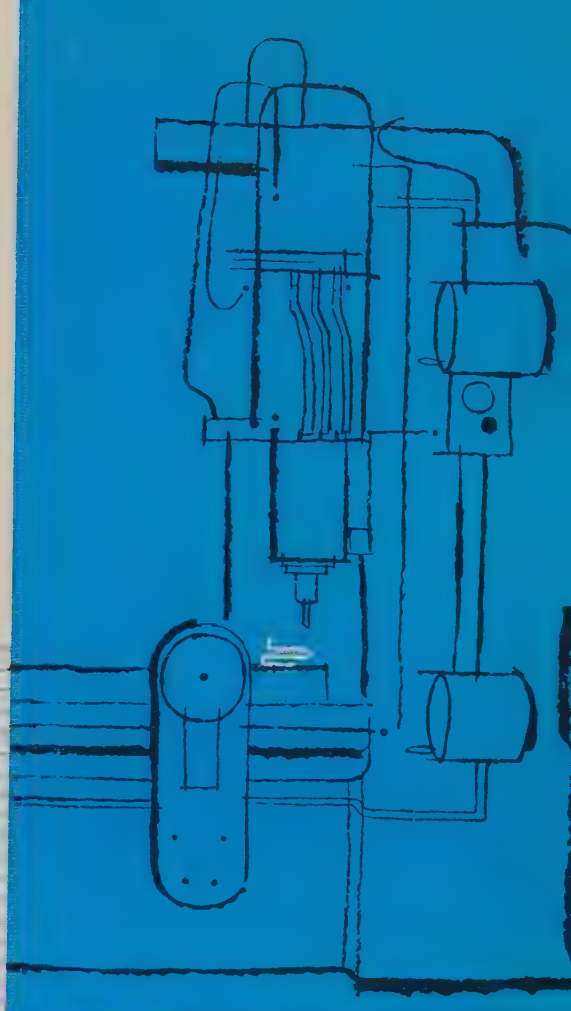

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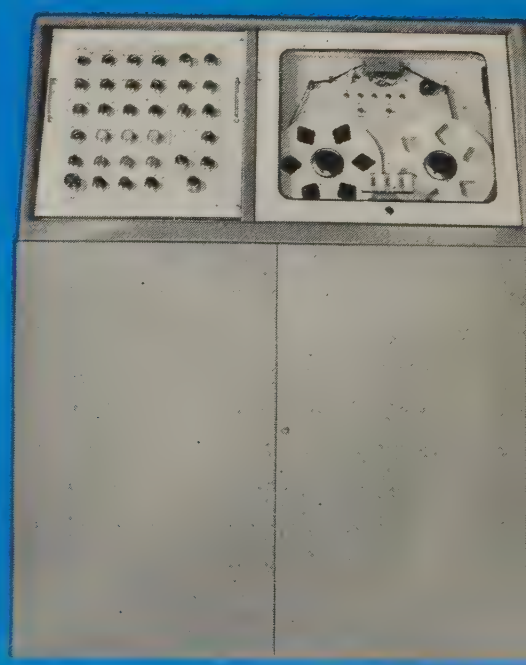

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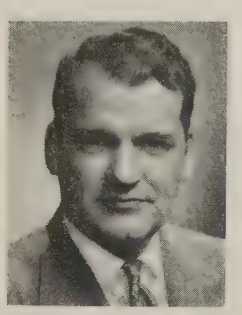

HENRY E. JENSEN
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Vice President
Pangborn Corp.
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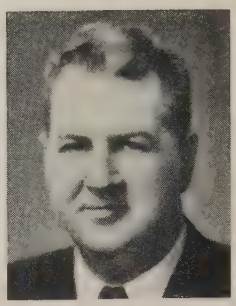

ORVILLE C. HOGNANDER
Vice President
C. H. Tennant Co.
Minneapolis

of other equipment. (Example: Protection must be given the demineralizers that prepare rinse water for electrolytic tin coating processes.)

Water flowing from mills must be relieved of suspended solids. Washing of flue gas or coal loads water with sediment that is often worth recovering. Coagulant aids can help recover ore from flue gas wash waters and, at the same time, assure compliance with anti-pollution laws.

Miniaturization in Batteries on Way To Meet Small Truck Needs

—HENRY E. JENSEN

• Among manufacturers of industrial storage batteries, development activity is expected to continue at an ever-increasing pace this year.

New types and sizes of batteries will be produced to meet growing demands of the electric truck industry. Typical of this is the decreasing size of electric trucks, which conserves aisle space. Storage battery manufacturers must produce smaller batteries with greater output.

Rubber covers and containers introduced two years ago have been improved and are now over 15 times more resistant to shock than containers previously used.

Until recently, standard lead-acid batteries, maintained in a charged condition by conventional trickle charge, have been used for tripping circuit breakers and starting stationary engines. A lead-acid battery with lead-calcium grids used with a constant voltage, current limiting, automatic silicon charger, has improved reliability and lengthened the life of such equipment. Annual water addition to the battery is the only maintenance required.

The battery was originally developed for power and communications, but is spreading to other fields. Newest of these is the starting of railroad diesel locomotives.

Cathodic Protection To Grow in Next Decade

—A. R. CORLETT

• Cathodic protection, an electrical means of preventing corrosion of buried or submerged structures, is in a period of dynamic growth which will continue well into the next decade.

The principle was first used to prevent external corrosion on oil and gas transmission lines and has proved its value so well that it's used on all new lines. Gas and water distribution piping, industrial plant utility piping, and process piping are applications where millions of dollars are saved annually in maintenance costs.

Cathodic protection is used for submerged surfaces in water tanks, water and sewage treatment equipment, chemical process tanks, and mixing chambers. Because the protection costs little when compared with former maintenance expense, it has been widely accepted.

Corrosion caused by salt water is stopped when cathodic protection equipment is installed on piers, ship hulls, and many other steel structures immersed in sea water.

Fume Control Equipment Must Be Tailored to Applications

—W. O. VEDDER

• Industrial growth in the next few years will add to the problem of air pollution, already severe in some industrial areas. The problem received national recognition when the National Conference on Air Pollution was called recently by the U. S. Department of Health, Education & Welfare.

Research by industrial and governmental agencies points out the complexities of industrial fume control.

More effective control of effluents can result from thorough study of offending processes or operations, and modification of present equipment.

Advances are being made constantly in fume and dust control equipment. Corrosion and heat resistant materials permit the modification of conventional fume control equipment for more effective use.

It is advisable to study the applicability of equipment to each fume control problem before installing it. If successful fume control cannot be studied in a plant similar to the one where the equipment is to be installed, a pilot plant test can establish requirements and specifications for the full scale installation.

Industry's Housekeeping Standards Get Stiffer

—ORVILLE C. HOGNANDER

• Because of increasing labor costs for manual sweeping and greatly changed housekeeping standards, it is likely that mechanical sweeping (even in congested areas) will be expanded significantly this year.

Missile manufacturing, the jet age, and public interest in controlling industrial dust nuisances are all having a marked effect on mechanical sweeping. Almost overnight, fine dusts and dirt have attained new stature as villians, upsetting previous standards of cleanliness.

Jet engines, for example, can be seriously damaged by dust from cracks and joints in paved taxiways and similar airport areas. Similarly, minute dust and ultrafine dirt—in certain phases of rocket and space missile assembly—become

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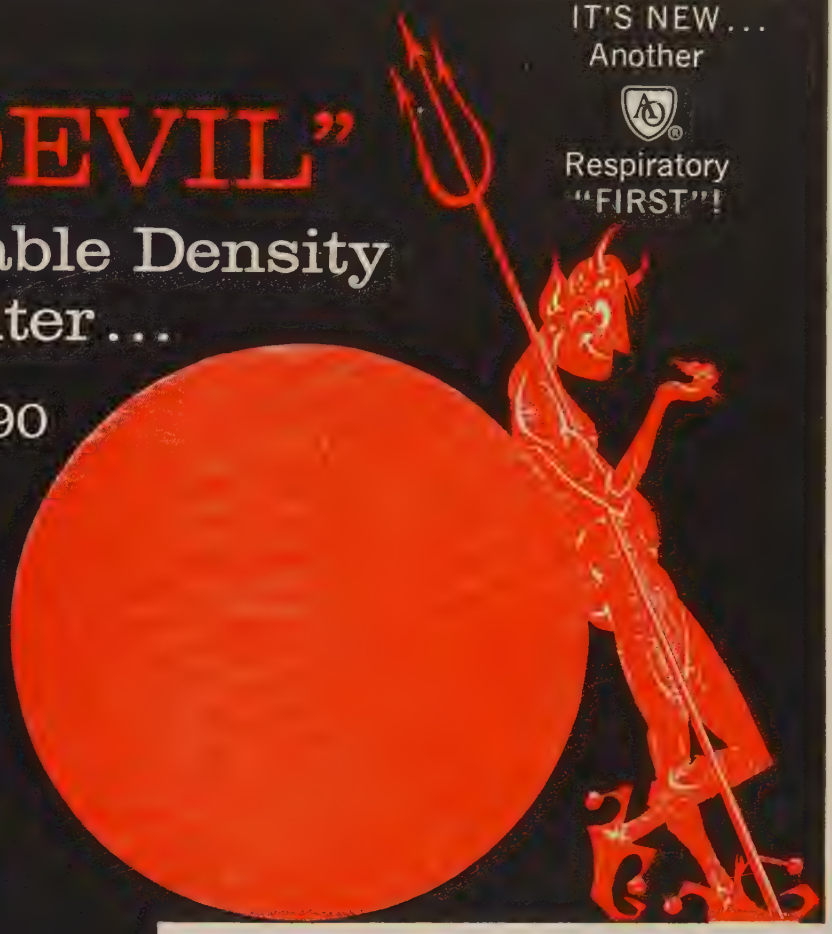

Greatest technical advance since American Optical introduced "impregnated (electrostatic) felt" in our R-25 filters which now give way to continuing AO research and progress. The Red Devil is available only from AO — provides amazingly high filtering efficiency, plus very low breathing resistance and unusually long service life because of a built-in pre-filter. BM approved for all dusts not significantly more toxic than lead, pneumoconiosis-producing mists and chromic acid mist. Act TODAY — equip personnel with the AO R-2090.

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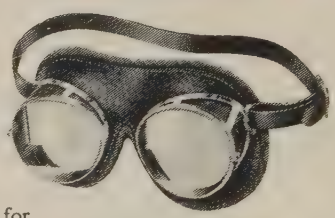

Foundrymen like the greater protection from the larger mask . . . the better vision from 57.8 mm. wide vision lenses . . . the stepped up (double) ventilation from a 40 mesh screen. Fits over most spectacle glasses. Adjustable rubber headband "clips" through metal frame for close fit. Soft plastic mask standard — leather available. Super Armorplate clear or Calobar lenses. Goggle also available with 150 mesh inner screen set behind a 16 mesh screen for dust protection — ask for No. 316.

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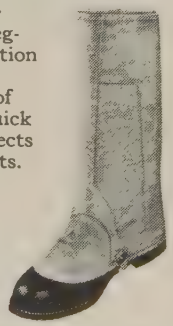
FABRIC — Latest in lighterweight materials offering protection against metal splash, heat and abrasion. Base material is asbestos with an aluminized-resin coating.

FEATURES — Quick release, knee-length legging — reinforced with fibre for shin protection and rigidity. Steel stay down length of legging positioned at bottom, and choice of 4 points at top. Leather tab at top for quick release. Leather flare and understrap protects instep. Also available in ankle length spats. Cat. No. 4903SA.



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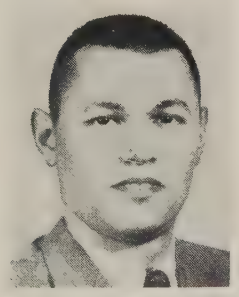


ROBERT DVORIN
Manager, Industrial Waste Treatment
Graver Water Conditioning Co.
New York

ROBERT C. HOOD
President
Ansul Chemical Co.
Marinette, Wis.

alarmingly important. Supersonic speeds and changed weight relationships make a big difference; and "white room" precision assembly areas now exceed hospital standards of cleanliness.

Removal of fine dust and dirt has become more important in industry. Increased plant output and the expansion of suburbs have resulted in the adoption of many techniques to reduce airborne dusts and generally improve industrial housekeeping.

Improved, high capacity, vacuumized sweepers have become standard equipment in certain dust problem industries, such as cement plants. They are also being used in ferrous and nonferrous metalworking plants.

A development in mechanical sweeping which saves travel time in sweeping plant aisles: Sweepers are built to fit the aisles. Sweeper manufacturers are working closely with industrial architects to determine sweeper dimensions for most economical use.

Cold Cured Finishes To Be Developed

—W. E. KEMP

• Developments in protective coatings will include chemically cured, solid coatings which are free from solvents or fire hazard, chemically cured, water emulsion coatings, and field applied coatings (organic and inorganic) which will exhibit high corrosion resistance and will not deteriorate at temperatures as high as 700° F.

In the last five years, a number of new organic and inorganic protective coatings have been developed for steel in corrosive environments.

Hot line coal tar enamels have extended the temperature range of hot applied thick mastics (90 to 100 mils) to 225° F. Extremely fast drying primers, synthetic resin based, show outstanding adhesion to steel and enamel under the most adverse temperature and humidity conditions.

Coatings of intermediate thickness (10 to 30 mils), include thermoplastic types that have little or no flow at temperatures up to 300° F, exhibit excellent corrosion resistance, and bond to a wide variety of surfaces with little surface preparation.

Epoxy resins, formulated with coal tar and cured at room temperature, show outstanding adhesion to steel and many other metals. They resist temperatures as low as −60° F and as high as 400° F.

Thin coatings (1-7 mils) include the zinc rich coatings, most of which are inorganic. For steel in marine service, they offer protection and freedom from explosion hazard during application, but their life expectancy depends on the rate of zinc loss from galvanic action.

Breakthrough Seen in Recovery Of Pickling Liquor in '59

—ROBERT DVORIN

• A dialysis system that can treat acid liquors and recover acids in tonnage quantities may provide the big breakthrough in pickle liquor treatment in 1959. It is estimated that 275,000 tons of free acid and 650,000 tons of ferrous sulfate are discharged annually in about 1 billion gallons of water. Up to 90 per cent of the acid can be recovered by dialysis; metal products are also recovered.

The new system is relatively simple in design and operation. It takes little floor space, requires no power, chemicals, or fuel for operation, and involves low capital investment.

An important feature of the system is its high transfer rate, due to the way it's designed and the plastic membranes used in it.

Maintenance cost is low because the membranes have high tensile strength and can be used for several years. The equipment requires only one operator, working part time, to see that the feed and recirculating pumps are operating properly.

The system operates on tap water and, in most cases, no water treatment is necessary.

In operation at a steel mill, the system recovers acid, leaving ferrous sulfate with a low acid content as a waste stream. Iron is then precipitated with lime or recovered by other available methods. Such a system reduces the amount of acid used in a process by permitting re-use of acids in process liquors; permits recovery of valuable products in the liquor by removing acids; and eliminates or substantially reduces the amount of acid to be neutralized. A higher concentration of acid can be used in the pickling bath, because the system operates at its best with highly concentrated solutions.

Recommends Dry Chemicals For Fire Protection

—ROBERT C. HOOD

• The metalworking industry will have better fire protection equipment in the early sixties—probably at no increase in cost.

There will be increased use of dry chemical extinguishing equipment in the form of portable fire extinguishers, hose systems, and systems incorporating use of piping with discharge through fixed nozzles.

Carbon dioxide extinguishers will be used only where special conditions make dry chemical extinguishers unsuitable (even though more effective).

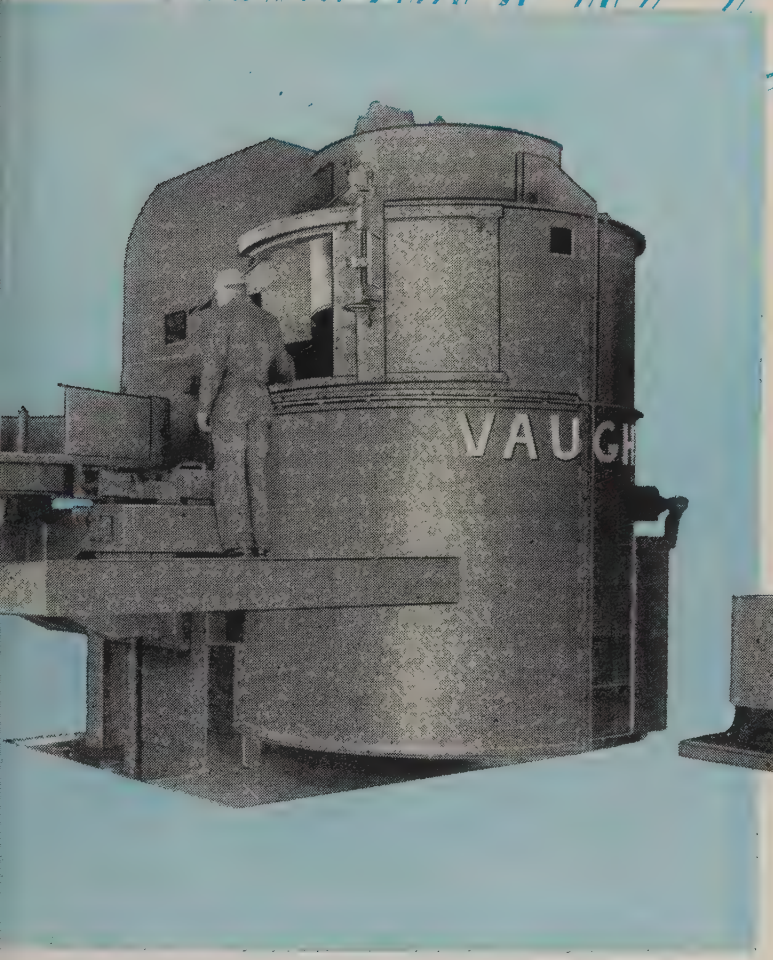
The newest of the dry chemical methods, the use of fixed nozzles, protects steel and aluminum rolling mills, oil quench tanks, and other flammable liquids. Once magnesium was the only combustible metal in the metalworking industry. Now there are several, with titanium and zirconium being the most common.

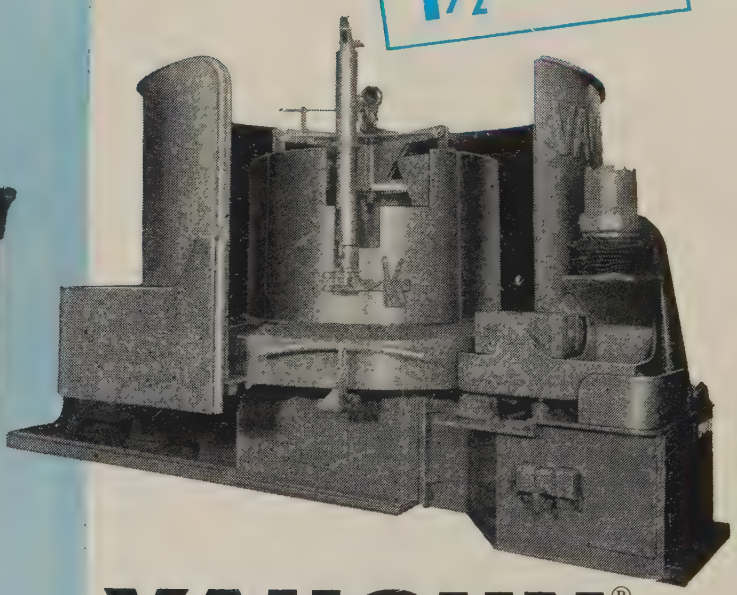
At present, two extinguishing agents

HERE'S *high speed* PRODUCTION OF *Long*

THIN WALL TUBING IN COILS

1½" TO ¼"





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for combustible metals are listed and approved by insurance companies. One is a graphite-base material which must be applied by scoop or shovel, and the other is a salt-base material which may be applied from extinguishers.

There are two other extinguishing agents suitable for fires in certain metals. One extinguishes fires in titanium turnings. It is a flammable liquid that burns and deposits an oxygen-excluding coat over the burning metal. The other, a special extinguishing agent, consists of graphite in a special form for expulsion from extinguishers. It was developed for use on fires in lithium.

Expects Wider Acceptance Of Rotary Compressors

—CHARLES E. FLORA

• It has been said that we have left the air age and have entered the space age. We believe a more appropriate term would be the age of technical progress.

During the next ten years, we will probably have reached the moon, or beyond. The speed of technological change and advancement is constantly increasing.

It is the responsibility of every industrial purchaser to buy only the capital equipment that will meet ever higher production standards and quotas.

In the air compressor industry, the greatest technical advances have been made with positive displacement rotary type compressors. Continued improvement can be expected in present designs. More compressor manufacturers will place rotary compressors on the market this year.

The changeover from reciprocating to rotary compressors will continue. The biggest single factor holding back this change is the lack of available information on rotary compressors at the industrial buying level.

People hesitate to accept anything they do not understand. A complete education program must be designed to inform industry what rotary compressors are available and to demonstrate how they differ from reciprocating units.

Improved Organic Coatings Will Protect Steel

—C. H. HEMPEL

• Corrosion of steel is more important than ever before in these days of high replacement costs. Although we may expect some new corrosion resistant alloys for certain special conditions, most emphasis will be placed on organic protective coatings for steel.

It is not likely that any other metal will ever replace steel as the fundamental metal of construction because of its strength, workability, abundance, and relative low cost. Its one weakness, corrosion, can be minimized by the right protective measures.

Corrosion may range from rust (atmospheric corrosion) to more complex forms found in chemical processing industries. Protective measures can be anything from red lead shop coat to the more complex baked resin coatings.

In the past, phenolic resin coatings were known to be brittle; recent improvements have overcome that problem. Flexible resin coatings can now be used in many applications not possible before; as a result, steel can be put to even wider use.

Pure resin coatings are gaining in popularity because of their chemical resistance, hardness, and heat resistance.

They can be subjected to temperatures as high as 600° F for 4 hours, or 500° for 100 hours before starting to deteriorate.

Surface preparation is vitally important; more efficient cleaners, inhibited pickling and etching baths, passivating pretreatments, and abrasive blasting techniques will find wider use.

Anticorrosive pigments are being used more in organic protective coatings. Equipment for water treating and heating—industrial, commercial, or domestic—will require improved corrosion protection because of increased demand for pure water.

The chemical and petroleum industries will need large quantities of protective coatings for factories, pipelines, tank cars, tank trailers, marine tankers, and storage or docking facilities.

Baked coatings, particularly the baked pure phenolics, will be used more in steel containers, appliances, and the chemical processing equipment, where coatings of the highest chemical resistance are required.

More Spending Expected for Quality Industrial Floors

—C. FRED YTTERBERG

• This year will be a better one, financially speaking, than was 1958. The industrial segment of the construction field will gain ground, but will fall short of the 1957 level.

Until now, most emphasis has been placed on better ways to make or process metal. Little attention, in comparison, has been given the housing of production facilities.

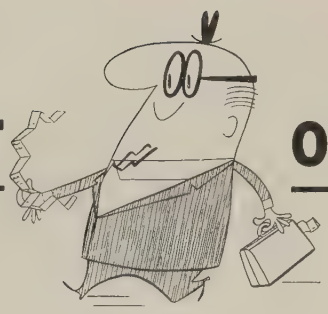
A general loosening of purse strings can be expected when budgets are set up this year. Last year, many builders were forced to cut corners because of small budgets.

Advances in industrial technology will call for more emphasis on quality in construction.

Research and development programs will not be started for improvement of industrial floors—but present programs will be continued and, in some cases, enlarged.

Demand for industrial floors that do not "dust" will increase. It is likely that germ-free or germ retardant floors will be standard for some applications in the near future.

1959 Calendar of Meetings



JANUARY

Jan. 11-14, Institute of Scrap Iron & Steel Inc.: Annual convention, Waldorf-Astoria Hotel, New York. Institute's address: 1729 H St. N.W., Washington 6, D. C. Executive vice president: Edwin C. Barringer.

Jan. 12-16, Society of Automotive Engineers: Annual meeting and engineering display, Sheraton-Cadillac and Statler-Hilton Hotels, Detroit. Society's address: 485 Lexington Ave., New York 17, N. Y. Secretary: John A. C. Warner.

Jan. 15, Malleable Founders' Society: Semiannual meeting, Hotel Sheraton-Cleveland, Cleveland. Society's address: 1800 Union Commerce Bldg., Cleveland 14, Ohio. Executive vice president: Lowell D. Ryan.

Jan. 19-20, Industrial Heating Equipment Association: Annual meeting, Hotel Sheraton-Cleveland, Cleveland. Association's address: Associations Bldg., Washington 6, D. C. Secretary: Robert E. Fleming.

Jan. 19-22, American Road Builders Association: Annual meeting, Statler-Hilton Hotel, Dallas. Association's address: 600 World Center Bldg., Washington 6, D. C. Executive vice president: L. W. Prentiss.

Jan. 20-21, Steel Shipping Containers Institute Inc.: Winter meeting, St. Regis Hotel, New York. Institute's address: 600 Fifth Ave., New York 20, N. Y. Secretary: L. B. Miller.

Jan. 25-29, Associated Equipment Distributors: Annual meeting, Conrad Hilton Hotel, Chicago. Association's address: 30 E. Cedar St., Chicago 11, Ill. Executive secretary: P. D. Hermann.

Jan. 26-28, American Management Association: West coast general management conference, Statler-Hilton Hotel, Los Angeles. Association's address: 1515 Broadway, New York 36, N. Y. General management division's manager: David J. Secunda.

Jan. 26-29, American Society of Heating & Air-Conditioning Engineers: International heating and air conditioning exposition and annual meeting, Convention Hall, Philadelphia. Society's address: 62 Worth St., New York, N. Y. Executive secretary: A. V. Hutchinson.

Jan. 26-29, Plant Maintenance & Engineering Show: Public Auditorium, Cleveland. Information: Clapp & Poliak Inc., 341 Madison Ave., New York 17, N. Y.

Jan. 26-28, Truck-Trailer Manufacturers Association: Annual meeting, Hollywood Beach Hotel, Hollywood, Fla. Association's address: 710 Albee Bldg., Washington 5, D. C. Executive manager: John B. Hulse.

Jan. 29-30, Steel Plate Fabricators Association: Annual meeting, Roosevelt Hotel, New Orleans. Association's address: 105 W. Madison St., Chicago 2, Ill. Secretary: J. Dwight Evans.

FEBRUARY

Feb. 2-7, American Institute of Electrical Engineers: Winter general meeting, Statler-Hilton and Sheraton-McAlpin Hotels, New York. Institute's address: 33 W. 39th St., New York 18, N. Y. Secretary: N. S. Hibshman.

Feb. 2-7, American Society for Testing Materials: Committee week, Penn-Sheraton Hotel, Pittsburgh. Society's address: 1916 Race St., Philadelphia 3, Pa. Executive secretary: Robert J. Painter.

Feb. 9-11, American Management Association: Marketing conference, Statler-Hilton Hotel, New York. Association's address: 1515 Broadway, New York 36, N. Y. Marketing division's manager: Coleman Lee Finkel.

Feb. 15-19, American Institute of Mining, Metallurgical & Petroleum Engineers Inc.: Annual meeting, St. Francis, Sheraton-Palace, Sir Francis Drake Hotels, San Francisco. Institute's address: 29 W. 39th St., New York 18, N. Y. Secretary: E. O. Kirkendall.

Feb. 16-18, American Management Association: Midwinter personnel conference, Palmer House, Chicago. Association's address: 1515 Broadway, New York 36, N. Y. Personnel division's manager: John D. Staley.

Feb. 18-19, Malleable Founders' Society: Technical & operation conference, Wade Park Manor Hotel, Cleveland. Society's address: 1800 Union Commerce Bldg., Cleveland 14, Ohio. Executive vice president: Lowell D. Ryan.

Feb. 26-27, Alloy Casting Institute: Winter meeting, Boca Raton Hotel, Boca Raton, Fla. Institute's address: 286 Old Country Rd., Mineola, N. Y. Executive vice president: E. A. Schoefer.

MARCH

Mar. 9-10, Steel Founders' Society of America: Annual meeting, Drake Hotel, Chicago. Society's address: 606 Terminal Tower, Cleveland 13, Ohio. Executive vice president: F. Kermit Donaldson.

Mar. 11-13, Pressed Metal Institute: Spring technical meeting, Pick-Congress Hotel, Chicago. Institute's address: 3673 Lee Rd., Cleveland 20, Ohio. Managing director: Harold A. Daschner.

Mar. 16-18, Society of Automotive Engineers: National passenger car, body, and materials meeting, Sheraton-Cadillac Hotel, Detroit. Society's address: 485 Lexington Ave., New York 17, N. Y. Secretary: John A. C. Warner.

Mar. 16-20, National Association of Corrosion Engineers: Annual conference and exhibit, Sherman Hotel, Chicago. Association's address: 1061 M & M Bldg., Houston 2, Tex. Secretary: T. J. Hull.

Mar. 16-20, Western Metal Exposition & Congress: Pan Pacific Auditorium and Ambassador Hotel, Los Angeles. Sponsor: American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. Assistant secretary: Ray T. Bayless.

Mar. 17-19, Investment Casting Institute: Annual meeting, Surf Rider Hotel, Santa Monica, Calif. Institute's address: 27 E. Monroe St., Chicago 3, Ill. Executive secretary: H. P. Dolan.

Mar. 17-19, American Machine Tool Distributors Association: Spring meeting, Sheraton Park Hotel, Washington, D. C. Association's address: 1900 Arch St., Philadelphia 3, Pa. General manager: James C. Kelley.

Mar. 19-20, Society of Automotive Engineers: National production meeting, Sheraton-Cadillac Hotel, Detroit. Society's address: 485 Lexington Ave., New York 17, N. Y. Secretary: John A. C. Warner.

Mar. 31-April 3, Society of Automotive Engineers: National aeronautic meeting and production forum, and aircraft engi-

neering display. Hotel Commodore, New York. Society's address: 485 Lexington Ave., New York 17, N. Y. Secretary: John A. C. Warner.

APRIL

Apr. 2-3, Metallurgical Society of AIME: Conference on physical metallurgy of stress-corrosion fracture, Mellon Institute, Pittsburgh. Society's address: 29 W. 39th St., New York 18, N. Y.

Apr. 5-9, Nuclear Congress and Atomfair: Public Auditorium, Cleveland. Co-ordinator: Engineers Joint Council, 29 W. 39th St., New York 18, N. Y. Secretary: E. Paul Lange.

Apr. 6-8, American Hot Dip Galvanizers Association Inc.: Annual meeting, Empress Hotel, Miami Beach, Fla. Association's address: 1806 First National Bank Bldg., Pittsburgh 22, Pa. Secretary: Stuart J. Swensson.

Apr. 6-8, American Institute of Mining, Metallurgical & Petroleum Engineers Inc.: Blast furnace and open hearth conference, Hotel Jefferson, St. Louis. Institute's address: 29 W. 39th St., New York 18, N. Y. Secretary: E. O. Kirkendall.

Apr. 6-8, National Association of Waste Material Dealers Inc.: Annual convention, Edgewater Beach Hotel, Chicago. Association's address: 271 Madison Ave., New York 16, N. Y. Managing director: Clinton M. White.

Apr. 6-10, American Welding Society: Welding show and technical meeting, International Amphitheatre and Sherman Hotel, Chicago: Society's address: 33 W. 39th St., New York 18, N. Y. National secretary: Fred L. Plummer.

Apr. 13-17, American Foundrymen's Society: Annual meeting and engineered castings show, Sherman and Morrison Hotels, Chicago. Society's address: Golf and Wolf Roads, Des Plaines, Ill. General manager: W. W. Maloney.

Apr. 13-17, American Management Association: National packaging exposition, International Amphitheatre, Chicago. Association's address: 1515 Broadway, New York 36, N. Y.

Apr. 14-16, Steel Shipping Containers Institute Inc.: Annual meeting, Miami, Beach, Fla. Institute's address: 600 Fifth Ave., New York 20, N. Y. Secretary: L. B. Miller.

Apr. 16-17, American Institute of Steel Construction: National engineering conference, Dinkler-Tutweiler Hotel, Birmingham. Institute's address: 101 Park Ave., New York 17, N. Y. Executive vice president: L. Abbett Post.

Apr. 16-17, Magnesium Association: Spring meeting, Congress Hotel, Chicago. Association's address: 122 E. 42nd St., New York 17, N. Y. Executive secretary: Jerry Singleton.

Apr. 18-22, American Society of Tool Engineers: Annual meeting, Milwaukee. Society's address: 10700 Puritan Ave., Detroit 38, Mich. Executive secretary: Harry E. Conrad.

Apr. 20-22, Metal Powder Industries Federation: Annual meeting and powder metallurgy show, Sheraton-Cadillac Hotel, Detroit. Federation's address: 130 W. 42nd St., New York 36, N. Y. Executive secretary: Kempton H. Roll.

Apr. 21-23, American Society of Lubrication Engineers: Annual meeting, Statler-Hilton Hotel, Buffalo. Society's address: 84 E. Randolph St., Chicago 1, Ill. Administrative secretary: Calvert L. Willey.

Apr. 22-24, American Zinc Institute Inc. and Lead Industries Association: Annual meetings, Drake Hotel, Chicago. Information: Lead Industries Association, 60 E. 42nd St., New York 17, N. Y. Secretary: Robert Ziegfeld.

Apr. 23-25, Metal Treating Institute: Spring meeting, Hollywood Beach Hotel, Hollywood, Fla. Institute's address: 271 North Ave., New Rochelle, N. Y. Executive secretary: C. E. Harington.

Apr. 26-29, National Screw Machine Products Association: Annual meeting, Roosevelt Hotel, New York. Association's address: 2860 E. 130th St., Cleveland 20, Ohio. Executive vice president: Orrin B. Werntz.

Apr. 27-29, Association of Iron & Steel Engineers: Spring conference, Statler-Hilton Hotel, Buffalo. Association's address: 1010 Empire Bldg., Pittsburgh 22, Pa. Managing director: T. J. Ess.

Apr. 27-29, Chamber of Commerce of the U. S.: Annual meeting, Chamber Bldg., Washington. Chamber's address: 1615 H St., Washington 6, D. C. Executive vice president: Arch N. Booth.

Apr. 27-29, Grinding Wheel Institute and Abrasive Grain Association: Semiannual meeting, Homestead Hotel, Hot Springs, Va. Information: Thomas Associates, 2130 Keith Bldg., Cleveland 15, Ohio. Business manager: W. B. Thomas.

MAY

May 3-6, American Steel Warehouse Association: Annual meeting, Drake Hotel, Chicago. Association's address: 540 Terminal Tower, Cleveland 13, Ohio. Executive vice president and secretary: Robert G. Welch.

May 3-7, Electrochemical Society Inc.: Spring meeting, Sheraton Hotel, Philadephia. Society's address: 1860 Broadway, New York 23, N. Y. Executive secretary: Robert K. Shannon.

May 10-13, Copper & Brass Research Association: Annual meeting, Homestead, Hot Springs, Va. Association's address: 420 Lexington Ave., New

York 17, N. Y. Managing director: Theodore E. Veltfort.

May 13-15, American Supply & Machinery Manufacturers Association: Triple industrial supply convention, Statler-Hilton Hotel, Dallas. Information: Thomas Associates, Keith Bldg., Cleveland 15, Ohio. Business manager: W. B. Thomas.

May 13-15, Machinery Dealers National Association: Annual meeting, Plaza Hotel, New York. Association's address: 1346 Connecticut Ave. N. W., Washington 6, D. C. Secretary: R. K. Vinson.

May 13-15, Southern Industrial Distributors Association: Spring meeting, Statler-Hilton Hotel, Dallas, Tex. Association's address: 1626 Fulton National Bank Bldg., Atlanta, Ga. Secretary-treasurer: E. L. Pugh.

May 14-15, National Association of Sheet Metal Distributors: Spring meeting, Pick-Roosevelt Hotel, Pittsburgh. Association's address: 1900 Arch St., Philadelphia 3, Pa. Executive secretary: Thomas A. Fernley Jr.

May 14-17, National Tool & Die Manufacturers Association: Spring board meeting, Marott Hotel, Indianapolis. Association's address: 907 Public Square Bldg., Cleveland, Ohio. Executive vice president: George S. Eaton.

May 17-20, Automotive Engine Rebuilders Association: Annual meeting, Royal York Hotel, Toronto, Ont. Association's address: 901 Roosevelt Bldg., Indianapolis 4, Ind. Executive vice president: R. G. Patterson.

May 17-20, Industrial Heating Equipment Association: Spring meeting, Homestead Hotel, Hot Springs, Va. Association's address: Associations Bldg., Washington 6, D. C. Secretary: Robert E. Fleming.

May 20-22, Electronic Industries Association: Annual meeting, Sheraton Hotel, Chicago. Association's address: 1721 DeSales St. N. W., Washington 6, D. C. Secretary: James D. Secrest.

May 20-22, Society for Experimental Stress Analysis: Spring meeting, Sheraton-Park Hotel, Washington. Society's address: P. O. Box 168, Cambridge 39, Mass. Secretary-treasurer: W. M. Murray.

May 25-27, American Society for Quality Control: Annual meeting and exhibit, Hotel Sheraton-Cleveland, Cleveland. Society's address: 161 W. Wisconsin Ave., Milwaukee 3, Wis. Administrative secretary: W. P. Youngclaus Jr.

May 25-26, Malleable Founders' Society: Annual meeting, Homestead Hotel, Hot Springs, Va. Society's address: 1800 Union Commerce Bldg., Cleveland 14,

(*Please turn to Page* 408)

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(Continued from Page 404)

Ohio. Executive vice president: Lowell D. Ryan.

May 25-26, Wire Reinforcement Institute Inc.: Annual meeting, Greenbrier Hotel, White Sulphur Springs, W. Va. Institute's address: National Press Bldg., Washington 4, D. C. Managing director: Frank B. Brown.

May 25-28, Design Engineering Show & Conference: Convention Hall, Philadelphia. Information: Clapp & Poliak, 341 Madison Ave., New York 17, N. Y.

May 27-28, American Iron & Steel Institute: Annual meeting, Waldorf-Astoria, New York. Institute's address: 150 E. 42nd St., New York 17, N. Y. Secretary: George S. Rose.

May 31-June 3, American Gear Manufacturers Association: Annual meeting, Homestead Hotel, Hot Springs, Va. Association's address: 1 Thomas Circle, Washington 5, D. C. Executive director: John C. Sears.

JUNE

June 2-4, National District Heating Association: Annual meeting, Skytop Club, Skytop, Pa. Association's address: 827 N. Euclid Ave., Pittsburgh 6, Pa. Secretary-treasurer: John F. Collins Jr.

June 9-12, Material Handling Institute Inc.: National exposition of material handling equipment, Public Auditorium, Cleveland. Institute's address: 1 Gateway Center, Pittsburgh 22, Pa. Managing director: L. West Shea.

June 11-12, Pressed Metal Institute: Sales conference, Bedford Springs Hotel, Bedford, Pa. Institute's address: 3673 Lee Rd., Cleveland 20, Ohio. Managing director: Harold A. Daschner.

June 14-18, American Society of Mechanical Engineers: Semiannual meeting, Chase-Park Plaza Hotel, St. Louis. Society's address: 29 W. 39th St., New York 18, N. Y. Secretary: O. B. Schier.

June 14-17, National Association of Purchasing Agents: Annual meeting and exhibit, Waldorf-Astoria Hotel, New York. Association's address: 11 Park Place, New York 7, N. Y. Executive secretary: G. W. H. Ahl.

June 14-17, National Industrial Advertisers Association: Annual meeting, Fairmont and Mark Hopkins Hotels, San Francisco. Association's address: 271 Madison Ave., New York 16, N. Y. President: John C. Freeman.

June 14-19, Society of Automotive Engineers: Summer meeting, Chalfonte-Hadden Hall, Atlantic City, N. J. Society's address: 485 Lexington Ave., New York 17, N. Y. Secretary: John A. C. Warner.

June 15-19, American Electroplaters Society: Annual meeting and industrial finishing exposition, Statler-Hilton and Sheraton-Cadillac Hotels, and Detroit Artillery Armory, Detroit. Society's address: 445 Broad St., Newark 2, N. J. Executive secretary: John P. Nichols.

June 16-19, American Marketing Association: National conference, Statler-Hilton Hotel, Cleveland. Association's address: 27 E. Monroe St., Chicago 3, Ill. Executive director: William C. Gordon Jr.

June 21-23, Alloy Casting Institute: Annual meeting, Homestead Hotel, Hot Springs, Va. Institute's address: 286 Old Country Rd., Mineola, N. Y. Executive vice president: E. A. Schoefer.

June 21-26, American Society for Testing Materials: Annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. Society's address: 1916 Race St., Philadelphia 3, Pa. Executive secretary: Robert J. Painter.

June 22-27, American Institute of Electrical Engineers: Summer meeting, Buffalo. Institute's address: 33 W. 39th St., New York 18, N. Y. Secretary: N. S. Hibshman.

JULY-AUGUST

July 13-15, Truck-Trailer Manufacturers Association: Semiannual meeting, Homestead Hotel, Hot Springs, Va. Association's address: 710 Albee Bldg., Washington 5, D. C. Executive manager: John B. Hulse.

July 29-Aug. 1, National Tool & Die Manufacturers Association: Summer board meeting, Grand Hotel, Mackinac Island, Mich. Association's address: 907 Public Square Bldg., Cleveland, Ohio. Executive vice president: George S. Eaton.

Aug. 10-13, Society of Automotive Engineers: National west coast meeting, Hotel Georgia, Vancouver, B. C. Society's address: 485 Lexington Ave., New York 17, N. Y. Secretary: John A. C. Warner.

Aug. 19-22, American Institute of Electrical Engineers: Summer general meeting, Sacramento, Calif. Institute's address: 33 W. 39th St., New York 18, N. Y. Secretary: N. S. Hibshman.

SEPTEMBER

Sept. 13-17, Pressed Metal Institute: Annual meeting, Stanley Hotel, Estes Park, Colo. Institute's address: 3673 Lee Rd., Cleveland 20, Ohio. Managing director: Harold A. Daschner.

Sept. 14-17, Society of Automotive Engineers: National farm, construction and industrial machinery meeting, production forum, and display. Milwaukee Auditorium, Milwaukee. Society's address: 485 Lexington Ave., New York 17, N. Y. Secretary: John A. C. Warner.

Sept. 16-17, American Die Casting Institute: Annual meeting, Edgewater Beach Hotel, Chicago. Institute's address: 366 Madison Ave., New York 17, N. Y. Secretary: David Laine.

Sept. 21-22, Steel Founders' Society of America: Fall meeting, Homestead Hotel, Hot Springs, Va. Society's address: 606 Terminal Tower, Cleveland 13, Ohio. Executive vice president: F. Kermit Donaldson.

Sept. 21-25, Instrument-Automation Conference & Exhibit: International Amphitheatre, Chicago. Sponsor: Instrument Society of America, 313 Sixth St., Pittsburgh 22, Pa. Executive director: William H. Kushnick.

Sept. 28-Oct. 1, Association of Iron & Steel Engineers: Annual meeting and convention, Sherman Hotel, Chicago. Association's address: 1010 Empire Bldg., Pittsburgh 22, Pa. Managing director: T. J. Ess.

Sept. 28-Oct. 1, American Welding Society: National fall meeting, Sheraton-Cadillac Hotel, Detroit. Society's address: 33 W. 39th St., New York 18, N. Y. National secretary: Fred L. Plummer.

OCTOBER

Oct. 4-7, National Association of Sheet Metal Distributors: Annual meeting, Atlantic City, N. J. Association's address: 1900 Arch St., Philadelphia 3, Pa. Executive secretary: Thomas A. Fernley Jr.

Oct. 5-7, Truck Body & Equipment Association Inc.: Annual convention and exhibit, Sherman Hotel, Chicago. Association's address: 1616 K St. N. W., Washington 6, D. C. Executive manager: Arthur K. Nuesse.

Oct. 5-10, Society of Automotive Engineers: National aeronautic meeting, aircraft manufacturing forum and engineering display, Ambassador Hotel, Los Angeles. Society's address: 485 Lexington Ave., New York 17, N. Y. Secretary: John A. C. Warner.

Oct. 7-9, Gray Iron Founders Society Inc.: Annual meeting, Fairmont Hotel, San Francisco. Society's address: 930 National City-E. 6th Bldg., Cleveland 14, Ohio. Executive vice president: Donald H. Workman.

Oct. 8-10, American Society of Tool Engineers: Semiannual meeting, Los Angeles, Calif. Society's address: 10700 Puritan Ave., Detroit 38, Mich. Executive secretary: Harry E. Conrad.

Oct. 11-16, American Society for Testing Materials: Pacific area national meeting and exhibit, Sheraton-Palace Hotel, San Francisco. Society's address: 1916 Race St., Philadephia 3, Pa. Executive secretary: Robert J. Painter.

Oct. 15-17, Foundry Equipment Manufacturers Association: Greenbrier Hotel, White Sulphur Springs, W. Va. Association's address: 1 Thomas Circle,

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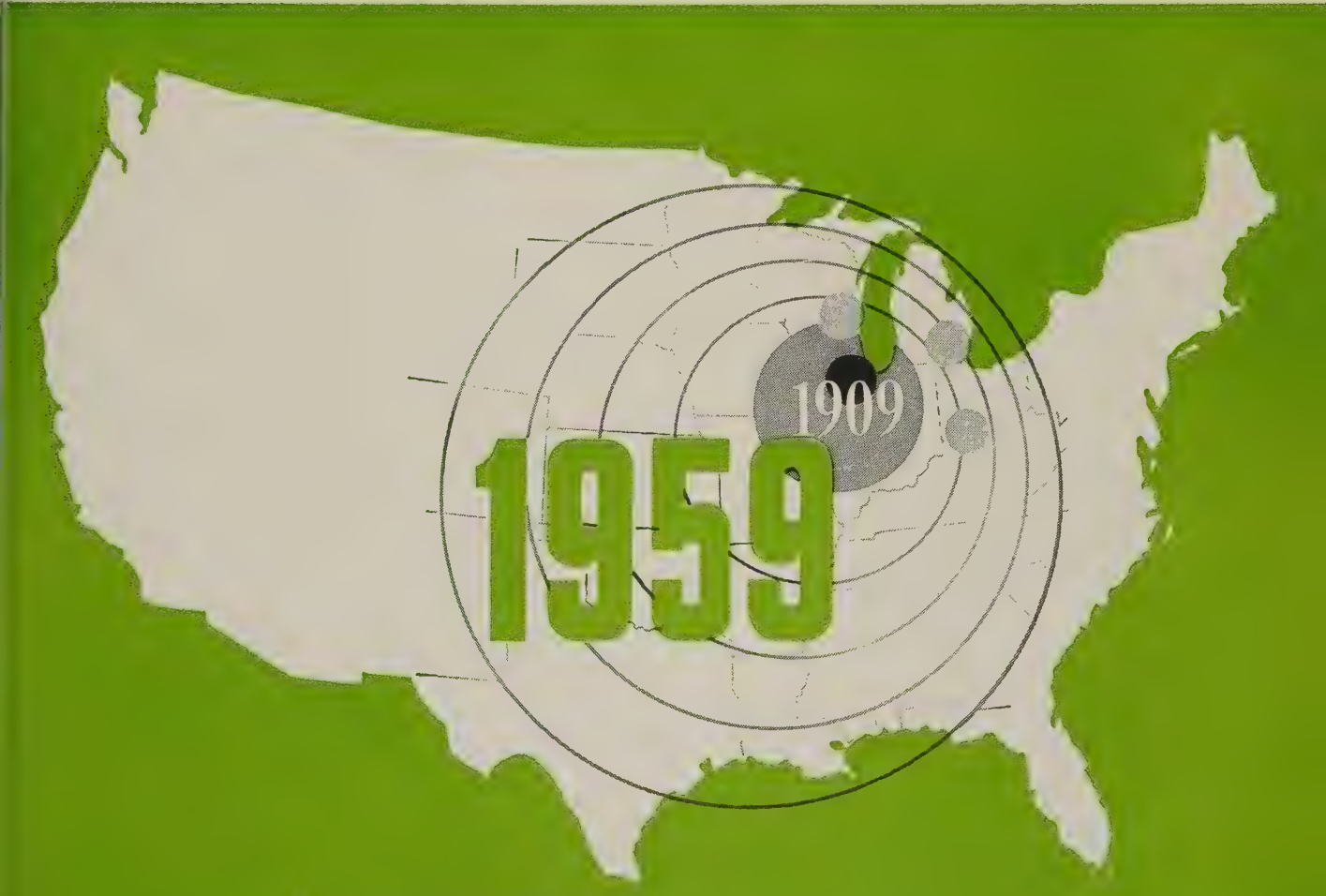

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MILWAUKEE 1, WIS. P.O. Box 1154, HUmboldt 1-5000

Washington 5, D. C. Secretary: C. R. Heller.

Oct. 18-22, Electrochemical Society Inc.: Fall meeting, Deshler-Hilton Hotel, Columbus, Ohio. Society's address: 1860 Broadway, New York 23, N. Y. Executive secretary: Robert K. Shannon.

Oct. 18-24, American Trucking Associations Inc. Annual meeting, Statler-Hilton and Biltmore Hotels, Los Angeles. Association's address: 1424 16th St. N. W., Washington 6, D. C. General manager: R. G. Atherton.

Oct. 19-20, Magnesium Association: Annual meeting and exhibit, Roosevelt Hotel, New York. Association's address: 122 E. 42nd St., New York 17, N. Y. Executive secretary: Jerry Singleton.

Oct. 19-21, American Society of Lubrication Engineers and American Society of Mechanical Engineers: Joint lubrication conference, Sheraton-McAlpin Hotel, New York. Information: ASLE, 84 E. Randolph St., Chicago 1, Ill. Administrative secretary: Calvert L. Willey.

Oct. 25-28, American Gear Manufacturers Association: Semiannual meeting, Edgewater Beach Hotel, Chicago. Association's address: 1 Thomas Circle, Washington 5, D. C. Executive director John C. Sears.

Oct. 25-27, American Machine Tool Distributors Association: Annual meeting, Statler-Hilton Hotel, St. Louis. Association's address: 1900 Arch St., Philadelphia 3, Pa. General manager: James C. Kelley.

Oct. 26-31, American Institute for Electrical Engineers: Fall general meeting, Pittsburgh. Institute's address: 33 W. 39th St., New York 18, N. Y. Secretary: N. S. Hibshman.

Oct. 26-28, Society of Automotive Engineers: National transportation meeting, LaSalle Hotel, Chicago. Society's address: 485 Lexington Ave., New York 17, N. Y. Secretary: John A. C. Warner.

Oct. 27-28, Society of Automotive Engineers: National diesel engine meeting, LaSalle Hotel, Chicago. Society's address: 485 Lexington Ave., New York 17, N. Y. Secretary: John A. C. Warner.

Oct. 28-30, Automotive Parts Rebuilders Association: Annual meeting and exhibit, Roosevelt Hotel, New Orleans. Association's address: 220 S. State St., Chicago 4, Ill. Executive secretary: Nathan M. Roberts.

Oct. 28-30, Society of Automotive Engineers: National fuels and lubricants meeting, LaSalle Hotel, Chicago. Society's address: 485 Lexington Ave., New York 17, N. Y. Secretary: John A. C. Warner.

Oct. 29-31, National Metal Trades Association: Annual meeting, Sheraton-Biltmore Hotel, Providence, R. I. Association's address: 337 W. Madison St., Chicago 6, Ill. Secretary: Charles L. Blatchford.

NOVEMBER

Nov. 2-5, Air-Conditioning and Refrigeration Institute: Industry exposition, Convention Hall, Atlantic City, N. J. Institute's address: 1346 Connecticut Ave. N. W., Washington 6, D. C. Managing director: Geo. S. Jones Jr.

Nov. 2-6, Metallurgical Society of AIME: Institute of Metals Division's fall meeting, Hotel Sherman, Chicago. Institute's address: 29 W. 39th St., New York 18, N. Y. Secretary: E. O. Kirkendall.

Nov. 2-6, National Metal Exposition & Congress: International Amphitheatre, Chicago. Sponsor: American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio. Assistant secretary: Ray T. Bayless.

Nov. 2-6, Society for Nondestructive Testing: Annual meeting, Hamilton Hotel, Chicago. Society's address: 1109 Minman Ave., Evanston, Ill. Secretary: Philip D. Johnson.

Nov. 3-4, Ultrasonic Manufacturers Association: Annual meeting, Hotel Sheraton, Chicago. Association's address: 271 North Ave., New Rochelle, N. Y. Executive secretary: C. E. Herington.

Nov. 4-6, Porcelain Enamel Institute: Shop practice forum, Ohio State University and Deshler-Hilton Hotel, Columbus, Ohio. Institute's address: 1145 19th St. N. W., Washington, D. C. Managing director: John C. Oliver.

Nov. 4-8, National Tool & Die Manufacturers Association: Annual meeting, Statler-Hilton Hotel, New York. Association's address: 907 Public Square Bldg., Cleveland, Ohio. Executive vice president: George S. Eaton.

Nov. 5-6, National Foundry Association: Annual meeting, Roosevelt Hotel, New York. Association's address: 53 W. Jackson Blvd., Chicago 4, Ill. Executive secretary: C. T. Sheehan.

Nov. 5-7, Metal Treating Institute: Annual meeting, Sheraton Hotel, Chicago. Institute's address: 271 North Ave., New Rochelle, N. Y. Executive secretary: C. E. Herington.

Nov. 8-11, National Association of Aluminum Distributors: Annual meeting, El Mirador Hotel, Palm Springs, Calif. Association's address: 1900 Arch St., Philadelphia 3, Pa. Secretary: R. Bruce Wall.

Nov. 9-11, Steel Founders' Society of America: Technical and operating conference, Carter Hotel, Cleveland. Society's address: 606 Terminal Tower, Cleveland 13, Ohio. Executive vice president: F. Kermit Donaldson.

Nov. 9-13, National Electrical Manufacturers Association: Annual meeting, Traymore Hotel, Atlantic City, N. J. Association's address: 155 E. 44th St., New York 17, N. Y. Managing director: Joseph F. Miller.

Nov. 11-15, National Association of Waste Material Dealers Inc.: Fall meeting, Diplomat Hotel, Hollywood Beach, Fla. Association's address: 271 Madison Ave., New York 16, N. Y. Managing director: Clinton M. White.

Nov. 15-19, National Screw Machine Products Association: Fall meeting, Americana Hotel, Miami Beach, Fla. Association's address: 2860 E. 130th St., Cleveland 20, Ohio. Executive vice president: Orrin B. Werntz.

Nov. 16-18, Packaging Institute: Annual meeting, Statler-Hilton, New York. Institute's address: 342 Madison Ave., New York 17, N. Y. Secretary: Charles A. Feld.

Nov. 17-20, Packaging Machinery Manufacturers Institute: Exhibition, Coliseum, New York. Show manager: Hanson & Shea Inc., 1 Gateway Center, Pittsburgh 22, Pa.

Nov. 29-Dec. 3, American Institute of Steel Construction: Annual meeting, Boca Raton Hotel, Boca Raton, Fla. Institute's address: 101 Park Ave., New York 17, N. Y. Executive vice president: L. Abbett Post.

Nov. 29-Dec. 4, American Society of Mechanical Engineers: Annual meeting, Chalfont-Haddon Hall, Atlantic City, N. J. Society's address: 29 W. 39th St., New York 18, N. Y. Secretary: O. B. Schier.

Nov. 30-Dec. 4, Exposition of Chemical Industries: Coliseum, New York. Information: International Exposition Co., 480 Lexington Ave., New York 17, N. Y.

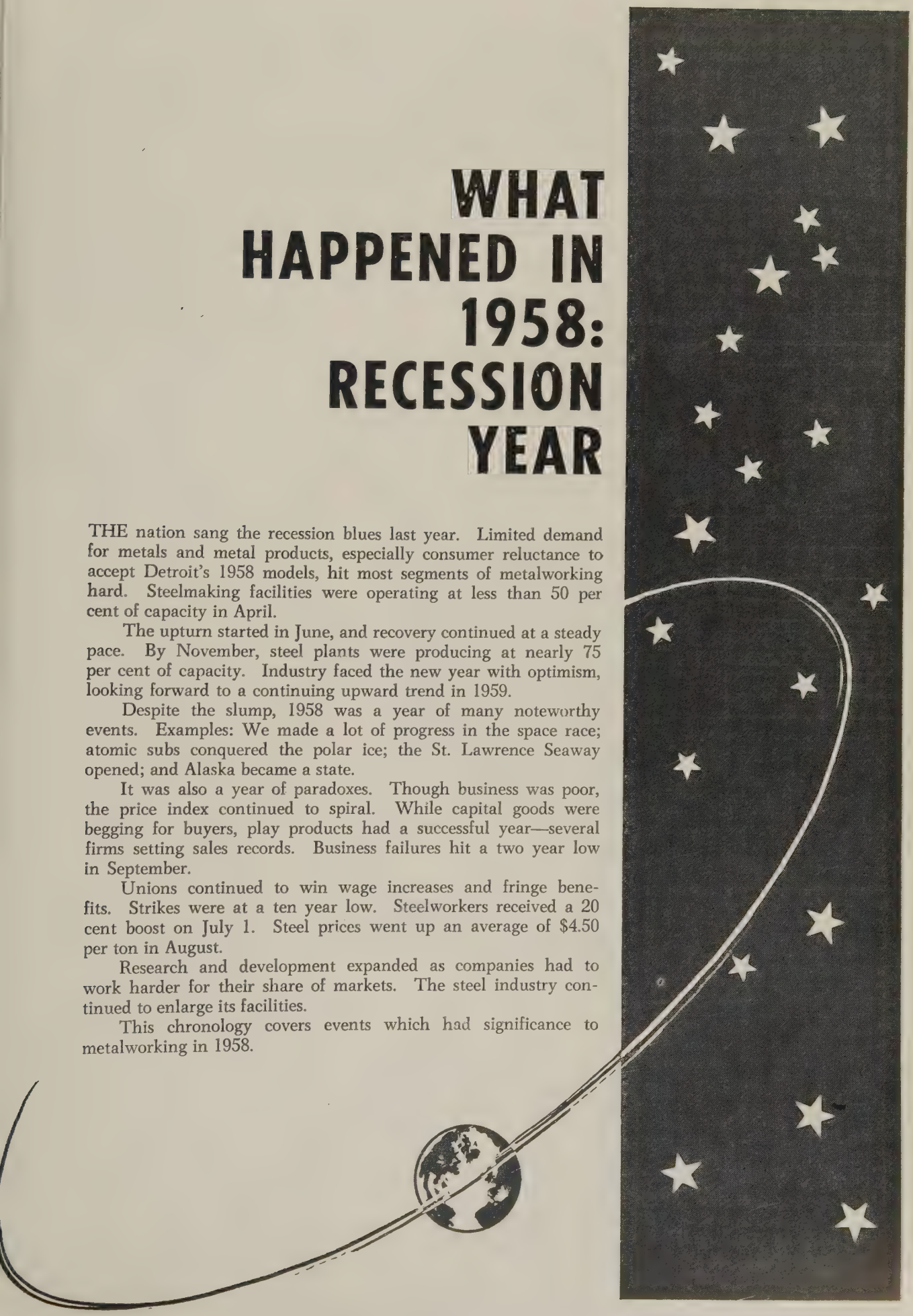
DECEMBER

Dec. 2-4, National Association of Manufacturers: Congress of American Industry, Waldorf-Astoria Hotel, New York. Association's address: 2 E. 48th St., New York 17, N. Y. Executive vice president: Charles R. Sligh Jr.

Dec. 2-4, Metallurgical Society of AIME: Electric furnace steel conference, Sheraton-Cleveland Hotel, Cleveland. Society's address: 29 W. 39th St., New York 18, N. Y. Secretary: E. O. Kirkendall.

Dec. 6-10, American Institute of Chemical Engineers: Annual meeting, Sheraton Palace Hotel, San Francisco, Calif. Institute's address: 25 W. 45th St., New York 36, N. Y. Secretary: F. J. Van Antwerpen.

WHAT HAPPENED IN 1958: RECESSION YEAR



THE nation sang the recession blues last year. Limited demand for metals and metal products, especially consumer reluctance to accept Detroit's 1958 models, hit most segments of metalworking hard. Steelmaking facilities were operating at less than 50 per cent of capacity in April.

The upturn started in June, and recovery continued at a steady pace. By November, steel plants were producing at nearly 75 per cent of capacity. Industry faced the new year with optimism, looking forward to a continuing upward trend in 1959.

Despite the slump, 1958 was a year of many noteworthy events. Examples: We made a lot of progress in the space race; atomic subs conquered the polar ice; the St. Lawrence Seaway opened; and Alaska became a state.

It was also a year of paradoxes. Though business was poor, the price index continued to spiral. While capital goods were begging for buyers, play products had a successful year—several firms setting sales records. Business failures hit a two year low in September.

Unions continued to win wage increases and fringe benefits. Strikes were at a ten year low. Steelworkers received a 20 cent boost on July 1. Steel prices went up an average of $4.50 per ton in August.

Research and development expanded as companies had to work harder for their share of markets. The steel industry continued to enlarge its facilities.

This chronology covers events which had significance to metalworking in 1958.

January

Steelmaking capacity reaches record 140.7 million net tons (ingots and castings), a 7.5 million ton increase from January, 1957. Outlook for 1958 production is 110.5 million net tons, vs. 113 million in 1957. Steel is readily available because of increased capacity and lower demand. Mills operating at a little over 50 per cent capacity. Scrap prices level after hitting bottom. Cost of living adjustment boosts wages 5 cents an hour.

Slight inflation and high volume in soft goods and services are expected to account for a slight rise in gross national product (to $445 billion) this year. New plant and equipment expenditures will drop from $37 billion to as low as $30 billion.

L. L. Colbert, president, Chrysler Corp., predicts retail sales of new cars may rise to 6 million mark in 1958. Preliminary reports indicate sales of 5.8 million.

Component buyers cut inventories. Only 13 per cent of respondents in survey indicate a stockpile increase.

President Eisenhower offers Congress a balanced budget of about $74 billion for fiscal 1959, including more than $40 billion for direct defense spending. He requests another $1.26 billion for defense in fiscal 1958, reflecting his confidence in a sharp upturn.

Walter Reuther substitutes a profit sharing demand for the short workweek as the economy slips.

Russia announces it will boost iron production from 85.9 million net tons in 1956 to 229.4 million net tons in 1970.

Material handling equipment makers see a $2 billion volume in 1958.

Washington announces $17.3 billion worth of new military spending in calendar 1958.

Court denies summary judgment in Bethlehem Steel Corp.-Youngstown Sheet & Tube Co. merger hearing. Trial set for Apr. 7.

Automakers expect to use 52 lb of aluminum per car in 1958, vs. 40 lb in 1957.

Federal Reserve Board lowers discount rate from 3 to 2¾ per cent.

Ford consolidates Mercury, Edsel, and Lincoln Divisions into M-E-L Div. under James J. Nance.

Retail auto deliveries are 22.2 per cent below 1957's.

February

Unemployment reaches 5.2 million.

Major producers reduce prices almost 1 per cent on two grades of stainless steel sheets and cold-rolled strip.

Atomic sub program gathers speed. Eighteen will be in operation by 1960.

American Motors Corp. reports it's in the black for the first time since the firm was formed in 1954, as Rambler sales boom.

Automotive steel purchases practically nil. Many February deliveries are pushed back to March.

Freight rate increases go into effect Feb. 15.

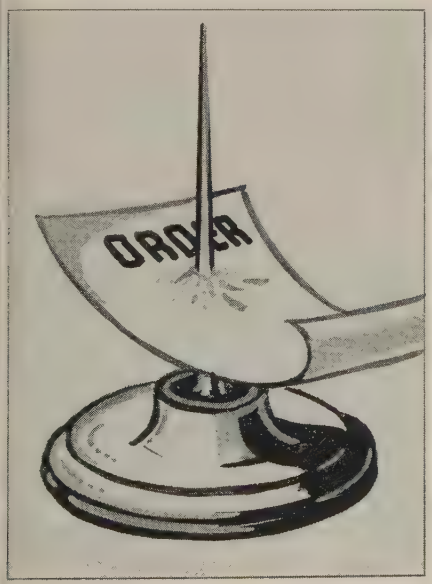
GE Vice President Roy W. Johnson heads Advanced Research Projects Agency. The new Pentagon arm will direct research and development of military space projects.

Cutting tool sales are off 30 per cent.

Steelmaking slips to 53.5 per cent of capacity (1,445,000 tons per week, vs. 2,501,000 ton rate in 1957.)

UAW pushes demands for severance pay as car sales slide; imports continue to mount. Some 300,000 foreign cars will be sold in U. S. in 1958.

Construction should be 4 per cent above 1957 record due to easier credit and ample structural steel.



Machine Tool orders hit their lowest level since 1949. Import problems get more acute in some lines, particularly standard machines.

Sen. Estes Kefauver's (D., Tenn.) Antitrust Committee charges that the $6 per ton steel boost last July "substantially exceeded" the rise in industry costs. It asks Federal Trade Commission to determine if pricing practices of the steel industry violate antitrust laws.

March

Average hourly wage rate in steel industry is record $3.09.

UAW President Walter Reuther talks tough, but members don't seem to be militant. Big Three contracts expire June 1.

Bulk of government aircraft contract negotiations take place this month. Big transfer from bombers to missiles is predicted for early 1970.

Container prices go up 2.3 per cent on Mar. 10.

Railroad working capital is down to $337,000 million, compared with $1,643,000,000 in December 1945.

Public works backlog is up.

Pentagon requests additional money for fiscal 1958 defense budget.

Machine tool orders rise slightly, but shipments slip.

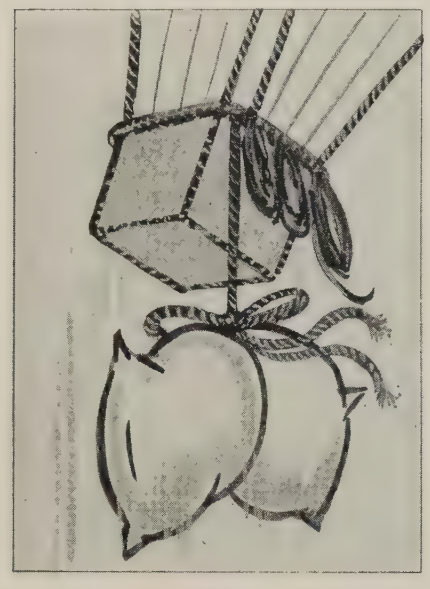
Station wagons capture record percentage of car market.

Steelmaking drops to 52.5 per cent of capacity.

Switch from liquid to solid fuels for missiles is expected to boost market for aluminum.

Ford Motor Co. tests prototype

for small car. Crash program is slated for late '59 or '60. GM readies tooling for Holden, Australian subsidiary, for small car introduction in 1960.



Consumer price index continues steady rise despite the recession.

Reciprocal Trade Agreements Act is extended one year.

Pittsburgh Consolidated Coal announces its coal pipeline from Cadiz, Ohio, to the Eastlake Power Station of the Cleveland Electric Illuminating Co. will be in operation within 90 days.

Aluminum manufacturers are operating well over 75 per cent of capacity.

President Eisenhower signs bill permitting $5 billion increase in the national debt limit.

Electronics move up to fourth place in manufacturing activity in the West.

UAW and Big Three start negotiations.

Railroad freight carloadings fall below year earlier levels for 31st consecutive week.

Auto assemblies are 38 per cent below March, 1957, pace.

Ingot and casting production is lowest (18.4 million tons) for a nonstrike quarter since 1946.

April

Aluminum price cut first time in 16 years.

American Motors gets $5.5 million contract for its light Mighty Mite truck. It's designed for air transport.

Administration seeks $40.7 billion in defense funds for fiscal 1958-59, including an emergency request for an additonal $1.6 billion for top-priority aircraft and missile programs.

Steel industry operations slide to 47.6 per cent of capacity.

President Eisenhower signs $1.8 billion dollar highway construction bill, despite serious misgivings. He objects to the government's increasing share of road building costs, but hopes the act will help ease unemployment.

St. Lawrence Seaway construction gets into high gear.

Scattered nonferrous price cutting continues.

American Motors copies labor's tactics, asks UAW (among other things) for two year wage freeze until Big Three wages catch up to AMC's.

Government plans for helping the railroads include: 1. Guarantees by Uncle Sam of five-year private loans up to $500 million for the purchase of capital equipment other than rolling stock. 2. Guarantee of loans totaling $200 million for 10 per cent of the purchase price of freight cars. 3. Revamped ICC jurisdiction so that roads can more easily drop losing business such as commuter runs. 4. Revised ICC ratemaking policies so that railroads can more effectively meet competition.

Right-to-work laws become issue in seven states—Delaware, Kansas, Colorado, California, Ohio, Idaho, and Washington.

Nonferrous extrusion market growing. A 7 per cent increase over record 1956 is anticipated. Magnesium extrusions having third best year in history. Aluminum sets the pace. Copper cheapest since 1951.

Machine tool builders ask for tariff boosts as high as 50 per cent over levels set in 1934.

First quarter steel production is 18.8 million tons (54.1 per cent of capacity).

First quarter earnings of six major steel firms are 73 per cent below what they were a year earlier.

Some 450,000 UAW members are out of work and not paying dues. The union shows a deficit of nearly $500,000 in its general fund for January and February.

STEEL campaigns for the revamping of depreciation policies, backs bill by Edgar W. Hiestand (R., Calif.).

Congress authorizes $2.5 billion for an interstate highway system for fiscal 1961.

Public apathy to 1958 autos dampens hopes for business pickup.

Continued public apathy toward 1958 autos dampens hopes for business pickup.

Blast furnaces operate at only 47 per cent of capacity.

Aluminum output exceeds that of like 1957 period by 2000 tons.

Fred A. Seaton, secretary of the interior, presents multimillion dollar metal subsidy program.

May

Russia shows big improvement in steel production.

Sen. Homer Capehart (R., Ind.) introduces depreciation bill (a tem-

(*Please turn to Page* 420)

(Continued from Page 416)

porary return to five-year amortization) which is similar to STEEL's recommendation.

UAW demands total wage increase of 73 cents an hour.

Unemployment reaches 7.5 per cent of work force.

Net profits of nonferrous companies in first quarter are way off pace of same 1957 period. Sales are off, and prices are down because of overproduction, lack of demand.

Steel production is up to 50 per cent of capacity.

Construction contracts total $3,402,464, the highest figure ever reported for a single month.

Aluminum block is announced as next major change in auto engines.

Tin plate prices go up May 27.

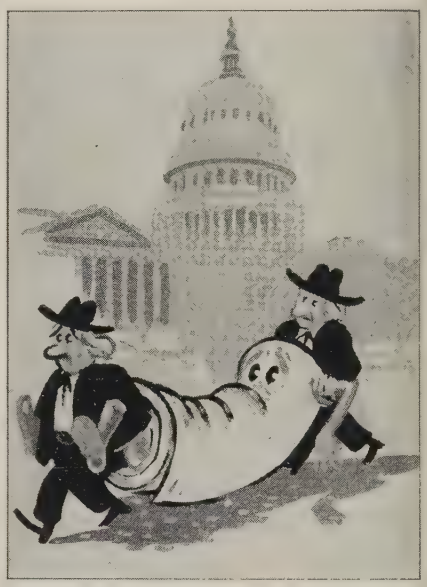
United Steelworkers ask fabricator shops for a wage package of 15 to 16 cents this year.

Reciprocal Trade Act is extended five years.

President Eisenhower takes stand against antirecession tax cuts. Renews his recommendation for extension of present corporation and excise taxes scheduled for automatic reduction June 30.

June

Worst of the recession is felt to be over because: 1. Personal income is firming. 2. New orders situation is improving. 3. Construction awards are rising.



Depreciation reform fails in 85th Congress. STEEL points to apathy of Congress and industry, lack of industry leadership, and failure to inform congressmen.

Proposed program for nonferrous metals sets limits on subsidy payments, gives the administration indirect control over domestic output.

Autoworkers are supporting Walter Reuther's program. Stand-fast policy of automakers seems to have backfired.

Sen. Homer Capehart (R., Ind.) fails to get expected support from businessmen for his depreciation reform measure.

President Eisenhower's proposal for a civilian space agency, National Aeronautics & Space Administration, O.K.'d unanimously by the House. It is expected to pass the Senate easily.

Steel production hits peak for year as furnaces reach 60.4 per cent of capacity.

House votes to extend corporate taxes at 52 per cent rate and excise taxes under a "no amendment" rule.

Scrap exports are about one-third below record 1957.

Custom smelters boost copper prices eighth time in three weeks

on June 11. The quotation, 26 cents a pound, is 1 cent a pound over primary producers' level.

Twelve unions representing 2000 employees at Ford, Chrysler, and GM agree to a two year contract extension.

Passage of House labor laws dim because nearly 40 per cent of House members are openly prolabor.

Canmakers appear to be recession proof. Production is expected to be 3 billion cans over '57's.

Anaconda Co. boosts price of copper 1.5 cents (to 26.5 cents a pound) on June 17. It's the first advance in primary since 1956.

Alan Wood Steel Co. is the first to raise steel prices ($6 per ton) effective July 7, but it rescinds the move when no one follows.

Leo Hoegh, federal civil defense administrator, heads new Office of Defense & Civilian Mobilization which replaces old FCDA and Office of Defense Mobilization.

Alcoa will begin aluminum production on two new potlines this fall at Massena, N. Y.

Republic Steel Corp. opens $18 million bar mill at its South Chicago plant. A new pipe mill will complete J&L's ten year, $200 million expansion program at Aliquippa, Pa.

Chevrolet releases orders for air-cooled aluminum engine. American Motors and Willys get military contracts to produce Jeeplike vehicles with aluminum engines.

July

Alaska becomes 49th state.

Steelmakers get automatic 20-cent boost in wages and fringes.

Aircraft company backlog is $200 million below that of 1957's first quarter as transition is being made to Space Age.

Air Force to spend $943 million in fiscal 1959 on major ground support items for surface to air missiles, estimates Aircraft Industries Association.

John McCrone, new AEC chairman, takes reins as Adm. Lewis L. Strauss departs.

Congress orders permanent status for Small Business Administration.

Senate passes Seaton Bill for domestic minerals stabilization.

Most major steel producers raise sheet and strip products $3 to $7 per ton.

Summer business level stays above recession low.

Average first half earnings for reporting steel companies off over 50 per cent.

Congressional approval given to National Aeronautics & Space Administration.

August

GE to start negotiating nonwage Union matters with IUE Sept. 2.

demands Guaranteed Annual Wage for third time.

Lake Carriers Association opposes charges on Great Lakes vessels using Welland Canal. Tolls for seaway users not contested.

Steel buyers end inventory cutbacks. User stockpiles near two-month level.

Big Three automakers risk a strike by standing pat with offer to extend present Autoworkers contract.

National ingot rate holds at 59 per cent of capacity.

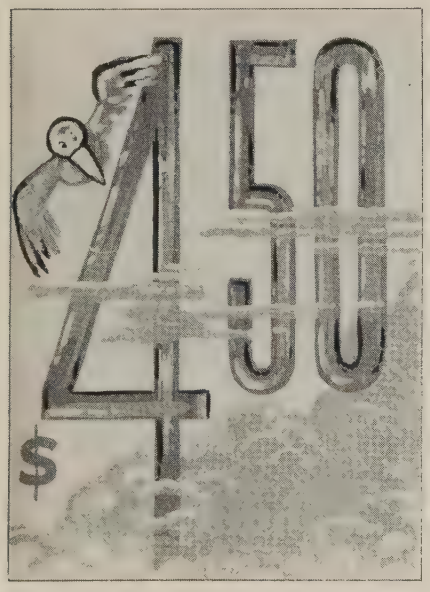
Don Rarick, presidential opponent of David J. McDonald, United Steelworker president, is still active. Anti-McDonald slates win several major union elections at local level. Much politicking expected at Steelworkers' convention.

Farm equipment, hit by the recession long before other segments of metalworking, is pulling out of the slump in a big way.

Prices of structural steel for federal highways have dropped 13 per cent in the last year.

U. S. Steel Export Co. advances prices on Aug. 12.

Nuclear subs *Nautilus* and *Skate* make historical runs beneath North Pole.



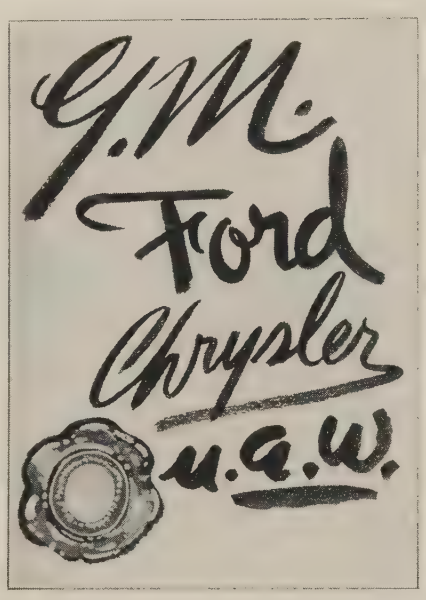
Steel prices are increased $4.50 per ton. In spite of hikes, demand picks up.

European Economic Community (West Germany, Italy, Netherlands, Belgium, and Luxembourg) set up to achieve economic integration.

Construction industry replaces autodom as top consumer of mill steel shipments in 1958. Construction demands bolster steel's recovery.

Wildcat strikes break out at Big Three plants as contract negotiations falter—although strikes are at ten year low nationally.

September



UAW-Big Three contracts signed. They are basically what management offered the unions last June.

Secretary Seaton's nonferrous metal bill is killed in closing sessions of Congress. It'll probably be reintroduced in different, more acceptable form at next session.

James J. Nance resigns as vice president and general manager of Ford's M-E-L Div., Dearborn, Mich. He is succeeded by Ben D. Mills, formerly head of the Lincoln Div., and most recently general manager of the M-E-L Div.

Steel ingot production hits 1958 peak of 1,751,000 tons (65 per cent of capacity).

Business failures hit two year low.

Production goal for steel ingots and castings in 1959 set at 110 million tons.

STEEL's scrap composite hits highest point since Sept. 27, 1957, rising to $43 per ton.

David J. McDonald, Steelworkers' president, asserts power at union's convention in Philadelphia. Group passes resolution to expel Don Rarick and backers from union if they continue to be difficult.

Automakers predict 5.5 million car sales in 1959.

U. S. Steel starts construction of a new blooming and structural mill at its South Works, South Chicago, Ill.

Base prices on tin plate go up to 25 to 35 cents per box Nov. 1.

Government establishes quotas to limit lead, zinc imports.

October

Railroads serving eight midwestern states will cut freight rates 3 to 35 cents on iron and steel products (excluding scrap) on Oct. 15.

Chrysler wins two important concessions in its new contract: Elimination of the Briggs contract by December, 1959, and tighter wildcat strike provisions.

Machine tool builders help to bridge recession by soliciting rebuilding jobs.

Steel employment costs reached new high of $104.56 per week in 1957's second half, AISI reveals.

Lead price advanced to 11.5 cents per pound as import limitations strengthen market.

Minneapolis, St. Paul & Sault Ste. Marie and New York Central offer preferred rates to shippers, regardless of size, who guarantee the roads a certain percentage of their business.

GM and Chrysler production hampered by strikes over local grievances.

Bureau of Public Roads reports road program finally approaching dimensions charted by planners in 1956. But it faces a shortage of funds. Several fund raising alternatives have been presented.

Studebaker-Packard Corp. introduces the Lark, an economy car. It's viewed as company's last chance. Initial response is encouraging.

The 1959 autos are slow to reach highways because of widespread strikes in the automaking industry.

Wave of nonferrous price fluctuations slows down as zinc and lead hold; copper rises to 29 cents, a 1.5 cent increase, on Oct. 23.

Westinghouse, GE buck SUB trend as they sell employees on savings plan, hope independent unions will want to embarrass IUE President James B. Carey.

Ingot rate reaches 75 per cent of capacity, high for the year.

Reynolds Metals Co. unveils the

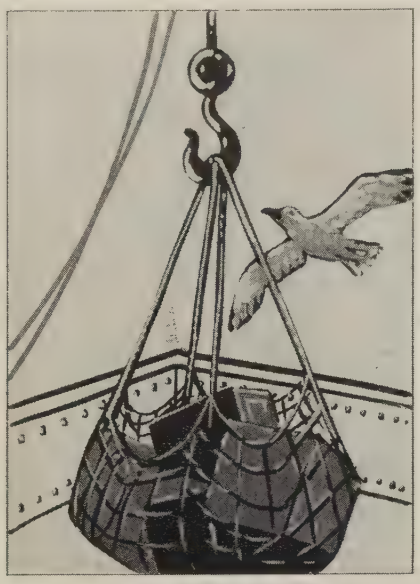
Bushing with a Bearing alloy lining

Now you can specify economical rolled, split steel bushings lined with bronze, babbitt, copper or aluminum alloy to provide bearing load-carrying qualities *with the advantages of low cost.* They are available in many lengths and diameters, with straight, clinch, butt or special seams. They can be ball indented and have oil holes, grooves, notches, slots, as required. Quality controlled manufacturing to meet your specifications. We provide complete engineering service. A copy of the "Formed Bushing Design Guide" will be sent on request.

FEDERAL-MOGUL DIVISION

FEDERAL-MOGUL-BOWER BEARINGS, INC., 11051 SHOEMAKER, DETROIT 13, MICHIGAN

Reynolds-Baroni bridge, made of aluminum. It's designed to compete with steel in the highway program.



Imports continue to rise as foreign producers cash in on low costs.

November

Structural steel bookings exceed expectations by 400,000 tons. Year's total will be about 2,650,000 tons. In first half, government work accounted for 45 per cent of bookings.

Dynapak, a method of explosive forming, is introduced by Convair, a division of General Dynamics Corp. It's one of the hottest ideas to hit metalworking in a long time.

Adm. Lewis E. Strauss, former AEC chairman, becomes Commerce Department head Nov. 10.

This will be one of the poorest years for the scrap industry since the thirties, says Myron L. Chase, president, Institute of Scrap Iron & Steel Inc.

Steel inventory buildup begins.

Substantial price reductions on titanium sponge, billet, and bar products made by Mallory-Sharon Metals Corp., Niles, Ohio.

West Germany passes the U. S. as the Free World's leading machine tool producer ($630 million, vs. $480 million in U. S. values).

Youngstown Sheet & Tube will spend $50 million to revamp Campbell (Ohio) strip mill. It'll take two years.

Nick Mamula, one of Don Rarick's followers in the revolt against steelworker prexy David J. McDonald is charged with "dual" unionism. He will be tried by the union. Similar action against other rebels is expected.

J&L extends expansion program to include 59 new Wilputte coke ovens at Pittsburgh, improved facilities at Cleveland, and a warehouse at Atlanta.

Ore shipping season closes earlier than usual on Nov. 28. Shipments total about 90 million gross tons.

Revamped barter programs developed by Department of Agriculture. Twenty-six minerals (including lead and zinc) are now eligible for barter contracts.

Right-To-Work succeeds in only one state, Kansas. Six states vote on it.

Judge Weinfeld rules against Bethlehem Steel Corp.-Youngstown Sheet & Tube Co. merger. He contends move would eliminate major producer from steel competition.

December

World steel output for year totals 294.7 million tons, vs. 322.1 million in 1957.

Pentagon starts to cut back, stretch, and cancel to meet defense budget. The Navy will end its Seamaster program with delivery of 14 instead 24 jets. Titan ICBM, Nike Hercules, Bomarc, and Talos are likely candidates for cuts or cancellations.

Strike-plagued automotive industry finally gets into sizable production, though work stoppages keep it below year ago levels.

Kaiser Aluminum & Chemical Sales Inc. shows the Pele, an all-aluminum car, in Detroit.

Steel inventories expected to reach 14 million tons by the end of year.

Fourth quarter shapes up as best of year.

Four U. S. wire producers file with the Tariff Commission for an investigation of damage being done to their industry by imports.

Decentralization by the Big Three and competition from captive and foreign producers create squeeze on Detroit tool and die shops.

United Mine Workers win $2 a day wage increase—$1.20 on Jan. 1, 80 cents on Apr. 1.

Renegotiation Act expected to be extended to June 30, 1962. Chance for reform is slipping.

Ferroalloy sales are expected to be about 80 per cent of 1957's.

Structural aluminum will compete with steel. Although it accounts for less than 5 per cent of all aluminum sales, the potential is great.

Right-To-Work proponents change tactics. Laws will be pushed in nonindustrial states in anticipation of great influx of industry into such regions.

Scrap people present problems facing their industry before Office of Civil & Defense Mobilization. Spokesmen request essentiality rating for the industry and minimum rate supports.

Supreme Court reverses Memphis decision of November, 1957. It means gas companies can raise rates without the consent of all consumers. Decision hailed as boon to gas industry expansion.

Red China doubles steel production in 1958.

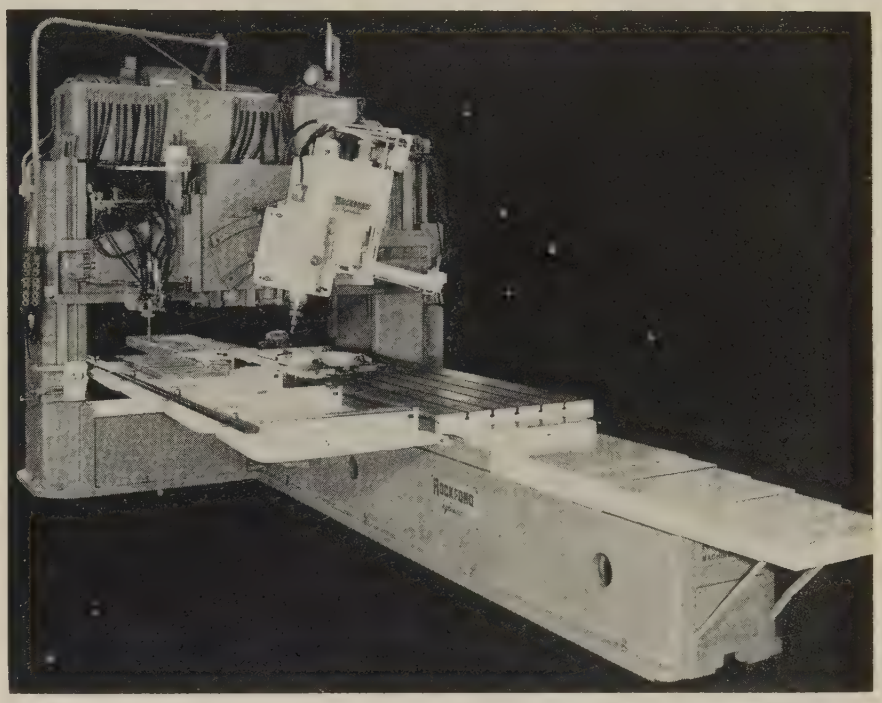
Swarfing Mill Machines Compound Surfaces

THIS machine is designed to meet the rigid requirements of the aircraft industry. Called the Hy-Draulic 3-D swarfing mill, it machines the joining edges of parts or subassemblies that have compound surfaces.

It combines the versatility and efficiency of hydraulic drive with the ease of manual stylus control.

Longitudinal, transverse, and vertical movements are transferred from full sized wood, plaster, plastic, or metal templates to the milling cutter by manual stylus control. This enables the operator to keep the milling cutter in full view and to have complete control of the feed rate at all times.

Sizes: 30 x 24 in., 36 x 24 in., and 42 x 24 in., with stroke lengths of 6, 8, 10, or 12 ft. For more information, *write* Dept. 213, Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.



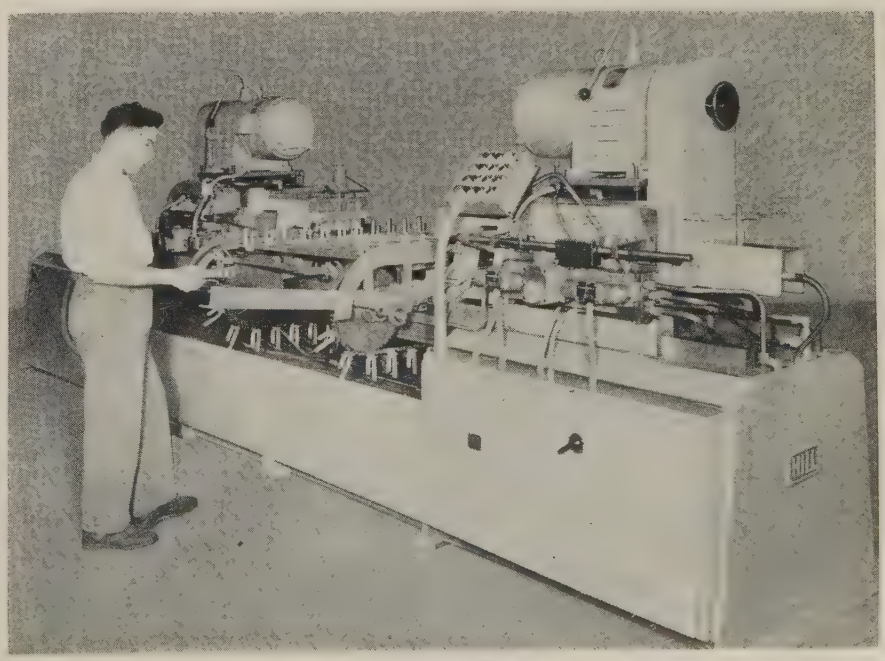
Transfer Machine Speeds Bar End Operations

HERE's an automatic, double-end transfer machine that can cycle at 3600 pieces an hour. It does six forming or cutting operations on each end of tubular or solid round stock up to 2 in. in diameter.

Operations include milling, centering, boring, threading, deburring, cutoff, spinning, flaring, forming, and dedimpling on ferrous and nonferrous parts.

Stock is fed to the machine conveyor; a transfer mechanism carries it through the machining or forming stations and deposits it on an exit conveyor or tote box.

In a typical operation, tubing for electrical conduit (1 to 2 in. in diameter, 10 ft long) is located endwise for clamping in the first station, cut to length in the second, dedimpled in the third, and deburred

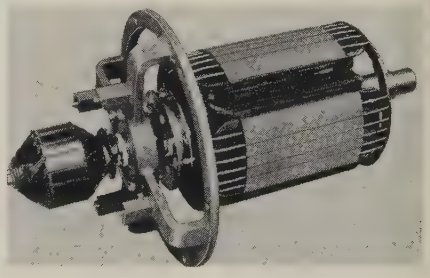


on the inside and outside in the fourth. Production: 1200 pieces an hour.

For more information, *write* Walter P. Hill Inc., 22183 Telegraph Rd., Detroit 19, Mich.

Brushless Generators Are Free of Sparking

HERE's a generator that can be used in hazardous, dusty, or abrasive atmospheres. Because it has no brushes, commutator, or slip rings, it requires practically no maintenance and eliminates sparking dangers.



High power silicon rectifiers make this development possible. Six rectifiers are mounted on a ring which rotates with the generator rotor. An alternating current exciter furnishes current to the rectifiers which, in turn, supply direct current for the generator field.

The units are available in ratings of 6.25 to 187 kva over a broad voltage range. For more information, *write* Electric Machinery Mfg. Co., Minneapolis 13, Minn.

Mobile Coolant Blender Is Maintenance-Free

IF YOU use water-soluble coolants mixed in ratios of 10:1 to 100:1, you can blend and dispense them from a portable unit made by the M. J. French Co.

One control handle varies the ratio of water and coolant. Designed as a one man unit, the maintenance-free blender uses two positive displacement pumps linked to metering valves to allow the infinite selection of coolant mixes.

A 75 gallon water tank and 5 gallon oil container on the unit are generally sufficient to make up

or fill a line of machines. You can install the unit permanently.

For more information, *write* M. J. French Co. Inc., P. O. Box 23, Brighton Station, Rochester 10, N. Y.

Hoists Extend Range

Three models of the CM Loadstar electric hoist extend the capacity range to 2 tons and double the lifting speeds in the ½ and 1 ton sizes.

The Model R has a capacity of 2 tons and lifting speed of 8 fpm, the Model L a 1-ton capacity at 16 fpm, and the Model J a ½-ton capacity at 32 fpm. *Write*: Chisholm-Moore Hoist Div., Columbus McKinnon Chain Corp., Tonawanda, N. Y. *Phone*: Jackson 2230

Automatic Ramp Is Activated by Truck

TO BRIDGE the gap between your loading dock and trucks, consider an automatic ramp introduced by American Dockbridge. It offers increased safety, reduced handling time and costs, and a more efficient flow of materials during loading and unloading.

When not in use, the ramp is level with the dock floor, making full crosstraffic possible. Hinged at the rear edge, the unit is activated when a truck backs into a push

frame in front. The elevating mechanism raises the front of the ramp to maximum height (16 in. above dock level) where it stops. As the truck continues backing, the ramp lowers until it rests on the back of the truck bed.

The dockbridge is available in 6, 8, and 10 ft lengths. Prices start at $695. For more information, *write* American Dockbridge Inc., 235 W. Oklahoma Ave., Milwaukee 7, Wis.

Radiotelephone Speeds Intraplant Handling

YOU CAN speed material handling in and around your plant by installing the Kaar TR325 mobile radiotelephone on your lift trucks and other handling vehicles.

Effective for about 5 miles, the two-way radio unit has been accepted by the FCC for licensing as a Class D radio station in the high frequency Citizens Band, 26.965 to 27.225 megacycles.

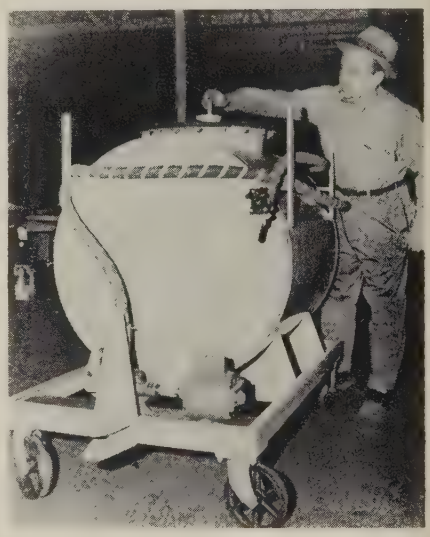
The TR325 can be operated from a 6 or 12 volt battery, or from 117 volts, ac. The price ($360) includes a hand microphone, a base loaded whip antenna, cables, and a shock mount. It can be used with an external speaker as a mobile paging system.

For more information, *write* Kaar Engineering Corp., 2995 Middlefield Rd., Palo Alto, Calif.

Unit Handles Acid

This acid transportation buggy has acidproof accessories. It moves acid safely.

The unit's steel tank is lined with rubber 3/16 in. thick. It is equipped



with a 35 gpm all-rubber, centrifugal pump with carbon seal; 1/3-hp motor; and an acidproof hose. *Write*: Perma-Line Rubber Products Corp., 1755 N. Winnebago Ave., Chicago 47, Ill. *Phone*: Humboldt 9-2020

Chemicals Remove Rust, Prevent Corrosion

TWO NEW compounds promise to make metal surface preparation easier.

Metclene is a compound that dissolves rust chemically and forms a rust resistant, nonmetallic surface. It can be applied by brush, spray, or dip. The manufacturer says that it provides a firm anchor for paints, lacquers, and enamels and prevents peeling.

Rustend is a special petroleum oil containing rust inhibitors and moisture repellents. A cationic molecular film protects steel, brass, and

aluminum from rust and water spotting. Steel treated with the compound has withstood 1600 hours of salt spray testing.

For more information, *write* Biofen Laboratories, 14 Sixth St., Bridgeport, Conn.

Speedy Bench Presses Have Tonnage Control

TWO bench presses introduced by Hannifin Co. will do those high speed forming, trimming, and force-fit assembly operations that require 6 to 8 tons of pressure.

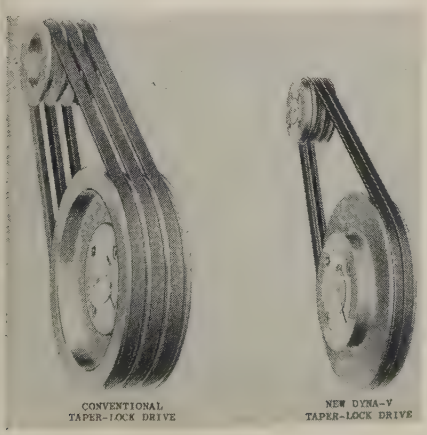
Tonnage is adjustable from 10 per cent of capacity to rated pressure. The return stroke is adjustable so you can shorten the work cycle to where the ram just clears the work-piece on repetitive operations.

Dual hand and adjustable down-stroke controls are standard. Electric pushbutton control with or without pressure reversal is optional. For more information, *write* Hannifin Co., division of Parker-Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.

Drives Feature Smaller Sheaves and V-Belts

THE NEXT V-belt drive you install may be the smallest you've ever used for the job. Reasons: Stronger metals for sheaves and synthetic rubbers and fibers for belts.

Called Dyna-V, the new line of drives covers the complete range of horsepower capacities available in conventional drives. The manufacturer says the majority of industrial drives can be handled with belts only 3/8 in. wide.



CONVENTIONAL TAPER-LOCK DRIVE

NEW DYNA-V TAPER-LOCK DRIVE

Dyna-V drives come in three sizes: The 3V model (3/8 in. belt) has sheaves with one to ten grooves for horsepowers of 1 to 50; the 5V series (5/8 in. belt) includes sheaves with three to ten grooves to handle up to 200 hp. An 8V series (1 in. belts) handles up to 1500 hp.

Taper-Lock bushings for quick mounting on the shafts are a standard feature of the sheaves. Belts have a crowned top and concave sidewalls for maximum efficiency.

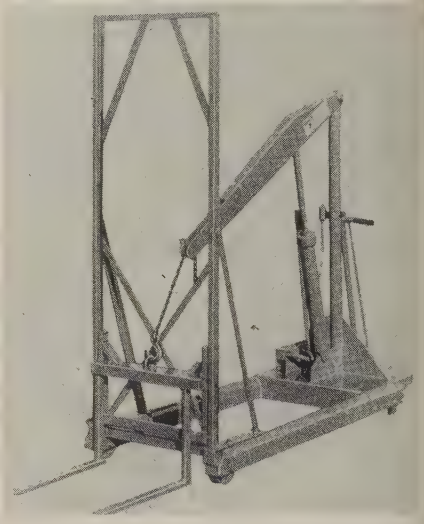
For more information, *write* Dodge Mfg. Corp., Mishawaka, Ind.

Attachment Converts Crane to Lift Truck

THIS Stack-or-Lift accessory makes your mobile hydraulic crane do the work of overhead cranes and lift trucks where those machines are not economical for general purpose lifting, stacking, and transporting.

The accessory can be attached or removed in a few minutes. Fork widths will adjust to fit most pallets; platform attachments for handling loose materials are optional.

Suggested safety limits: 1/2 ton



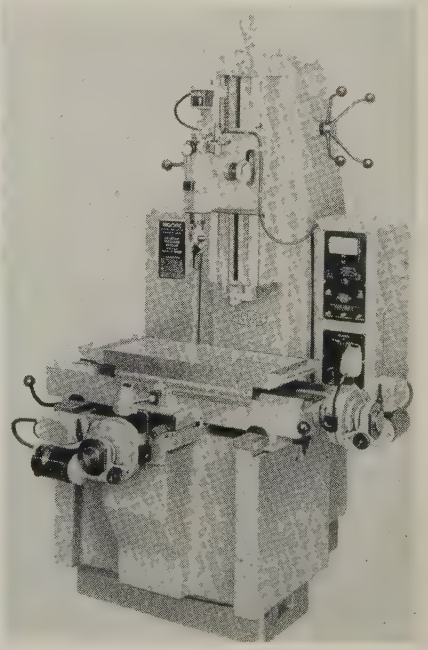
cranes, 350 lb; 1 ton cranes, 600 lb. The capacity of 1 ton models can be increased 60 per cent by adding a 150 lb counterweight.

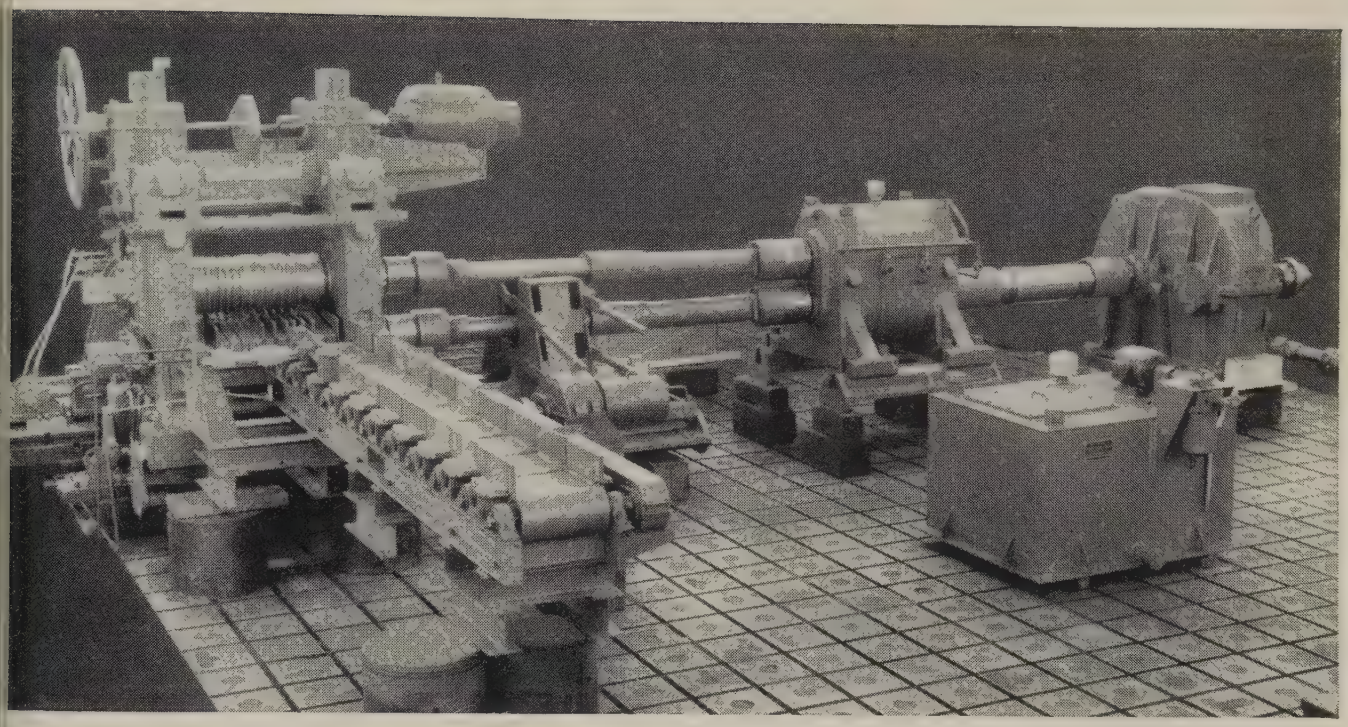
For more information, *write* Ruger Equipment Inc., 174 W. Fourth St., Uhrichsville, Ohio.

Measuring Machine Has Large Capacity

HERE is a measuring machine that checks large workpieces at labortory tolerances. It is capable of measuring to one-third of a ten-thousandth inch.

The machine has a work capacity of 11 x 18 x 18 in. It features motorized table positioning with accurate horizontal and cross lead





BIRDSBORO *hot mill to roll refractory metals at 3500° to 4000° in Universal-Cyclops' IN-FAB Facility*

Other important features

- A hydraulic system operates the auxiliary manipulators, the pinch rolls, the moving side guard and the mill stand transverse motion. It has an automatic oil lubrication system.
- Each new pass requires a transverse motion of the entire mill stand (the universal spindles are telescoping) in relation to the fixed material entry position on the table.
- The transverse mill stand motion is accomplished by a hydraulic cylinder remotely controlled from the pulpit with a potentiometer circuit.
- Purpose of the mill stand transverse motion is to eliminate costly manipulators and bar-turning devices which are needed in high production mills.

• This new combination 16″-14″ two-high reversing mill will roll refractory metal flats, squares and rounds in an inert atmosphere. Designed and built by Birdsboro, it can roll 2½″ to ½″ rounds and squares starting with 4″ x 4″ billets. The mill is 90% mechanized to reduce the number of men needed to operate it and to minimize production costs.

All rolling will be done automatically and controlled by an operator in a remote pulpit. The air is replaced by argon gas so Universal-Cyclops Steel Corporation can efficiently fabricate refractory metals at their best working temperatures. Employees will work in gas tight suits, entering the plant through an air lock.

Birdsboro's custom-engineering of special machinery frequently adds the all-important creative element to mill machinery design and building. This creativity is proving to be worth profit dollars for Birdsboro customers. Contact your nearest Birdsboro representative or the Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., *Main Office, Engineering Department and Plant:* Birdsboro, Pa., *District Office:* Pittsburgh, Pa.

MM 71-58

BIRDSBORO
STEEL FOUNDRY AND MACHINE CO.

STEEL MILL MACHINERY • HYDRAULIC PRESSES • CRUSHING MACHINERY • SPECIAL MACHINERY • STEEL CASTINGS • Weldments "CAST-WELD" Design • ROLLS: Steel, Alloy Iron, Alloy Steel

screws. The user has a choice of an electronic indicator supported on a rotatable spindle or a universal microscope for pickup.

The manufacturer offers a rotary table and a microsine table for accurate angular and compound angular settings. For more information. *write* Moore Special Tool Co. Inc., 800 Union Ave., Bridgeport 7, Conn.

Cleans Large Castings

A 6-ft Rotoblast Table-Room provides cleaning of work in foundries and plants that require a flexible machine for a wide range of cleaning operations.

It is capable of handling castings, forgings, and stampings to 72

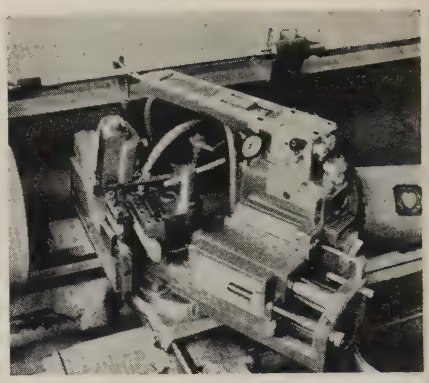
in. in diameter, 36 in. high, and weighing to 5000 lb.

The table is equipped with a sealing system that makes the cabinet abrasivetight without rubber gaskets. A single overhead wheel throws 50,000 lb of abrasive an hour. *Write*: Pangborn Corp., Hagerstown, Md.

Tracer Attachment Makes Lathes Automatic

YOU CAN convert lathes with up to 27½ in. swing for automatic multiple shaft turning, facing, turning, and boring contoured work with a new, self-contained, hydraulically operated tracer attachment.

The manufacturer says it will do the work of an automatic at a fraction of the cost. It is equally useful on production work, short runs, or one-of-a-kind maintenance and toolwork.



The unit mounts in place of the standard lathe compound slide and may be swiveled to any angle. Round or flat shapes in wood or metal may be used as templates, or you can use a standard workpiece.

Templates or prototype parts are mounted at the back of the lathe. Mounting brackets are available to fit any lathe without impairing the normal swing or traverse.

For more information, *write* Leland - Gifford Co., Worcester 1, Mass.

Moving Table Ups Output

YOUR assembly jobs can be speeded by a work bench with a built-in material flow line.

Available in various lengths and belt widths, the Table-Veyor units are also suitable for inspection, checking, sorting, testing, small order packing, and similar operations.

For more information, *write* Rapids-Standard Co. Inc., 342 Rapistan Bldg., Grand Rapids 2, Mich.

Strapping Unit Makes 17 Ties a Minute

IF YOU'VE been hand strapping corrugated cartons, fiber cartons, and wooden cases, you'll want to look into this machine. It can make up to 17 ties a minute.

It automatically compensates the tension on the strap for variations in package size. Minimum package size it can handle is 4 in. high and 8 in. wide. You can strap packages up to 22 in. high and 20 in. wide, or 15 in. high and 26 in. wide.

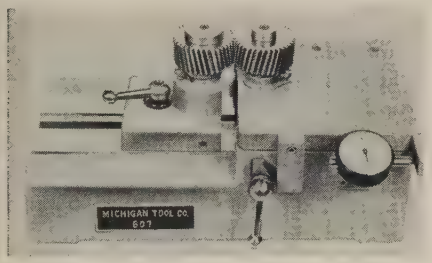
The machine uses either light or medium gage flat steel strapping. It forms the seals from a coil in the

machine and can make 7500 ties without reloading. For more information, *write* A. J. Gerrard & Co., 1950 Hawthorne Ave., Melrose Park, Ill.

Fixture Checks Size Meshing of Gears

HERE is a low cost, bench type rolling fixture for checking size, eccentricity, and meshing smoothness of spur and helical gears up to 10 in. in diameter. They are rolled against a master.

All deflections are shown on an integrated dial indicator in increments of 0.0005 in.



The precision bushing used on the master gear and part stud is replaceable. Master gear rotation can be in the bore of the master, or in the bushing—a feature that greatly extends the service life of the equipment.

The rolling fixture can be used with an automatic recorder to keep a record of the inspection on permanent charts. For more information, *write* Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

Transformer Gives You 110 Volts at Machine

WHEN you need 110 volts at machines or other stations where 220 or 440 volt sources are present, you can get it easily and safely with a compact transformer unit introduced by Mullenbach.

The unit can be bolted directly to machines or other equipment operating on the higher voltages. Since no external wiring is required, the transformer can be installed and serviced by the plant's regular maintenance crew.

For more information, *write* Mullenbach Div., Electric Machinery Mfg. Co., Los Angeles, Calif.

Horsepower Increased

Whitney-Tormag magnetic drives are available from stock in 3 and 5 hp units. They are self-contained power transfer units that provide motor and equipment protection from sudden starts, stops, and overloads.

They will run under full-stall conditions for extended periods without overheating or overloading the motor or driven machinery. *Write*: Whitney Chain Co., Hartford, Conn. *Phone*: Jackson 7-8261

Heater Is Portable

A recirculating, oil fired, portable heater provides temporary heat for shops, warehouses, shipping platforms, or any unheated area. A thermostatic control insures against fuel waste.

The heater is useful in thawing out frozen equipment and material. Models are available in six sizes from 100,000 to 1,000,000 Btu an hour. *Write*: Stow Mfg. Co., 63 Shear St., Binghamton, N. Y. *Phone*: 3-6411

NEW literature

Write directly to the company for a copy

Welding Wire Chart

Bulletin DH-1218-O compares Page welding wire with virtually all competitive makes. It details physical properties as welded, gives analyses, tensile strength, elongation, and average hardness. It also lists typical uses of gas welding rods, bare electrodes, automatic welding wire and metal spray wire. Page Steel & Wire Div., American Chain & Cable Co. Inc., Monessen, Pa.

Surface Grinding Machines

Two brochures give specifiactions on the new Brown & Sharpe 510 and 618 surface grinders. Accessories for the machines are also listed. Machine Tool Div., Brown & Sharpe Mfg. Co., Providence 1, R. I.

Tubular Products

A 14-page brochure gives specifications and characteristics of stainless, nickel alloys, and special metal tubing that ranges from hypodermic sizes up. J. Bishop & Co., Malvern, Pa.

Molybdenum in Steel Castings

The role of molybdenum in heat treated low alloy steel castings is the subject of a 36-page brochure. Discussed are hardenability, tensile properties, fatigue, wear, and impact resistance of cast steels. Climax Molybdenum, 500 Fifth Ave., New York 36, N. Y.

Iron Powder Information

Here is a 52-page book that contains complete technical data on Republic types cdf and MS iron powders. Most of the necessary information regarding a powder's behavior can be read from charts. Republic Steel Advertising Div., 1441 Republic Bldg., Cleveland 1, Ohio.

How To Fabricate Hastelloy

A 36-page booklet gives procedures for welding, forging, forming, machining, grinding, brazing, heat treating, descaling, and pickling the Hastelloys B, C, D, and F. Haynes Stellite Co., division of Union Carbide Corp., Kokomo, Ind.

Waste Treatment Product

Dowpac, a new plastic packing material used in the biological oxidation of liquid wastes, is discussed in a 32-page bulletin. It contains information on the material's properties, assembly instructions, and operational characteristics. Plastics Dept., Dow Chemical Co., Midland, Mich.

Stainless Buyers' Guide

Directed toward purchasing agents, designers, and fabricators, this 159-page book lists about 3000 firms which make stainless steel products or offer services. Manufacturers are listed under 188 specific and general product categories. Committee of Stainless Steel Producers, American Iron & Steel Institute, 150 E. 42nd St., New York 17, N. Y.

Wrought Iron for Drainage

A 64-page booklet on wrought iron for building drainage systems is for architects, engineers, building owners, contractors, and maintenance supervisors. It discusses piping for soil, waste, vent, and downspout applications. A. M. Byers Co., P. O. Box 1076, Pittsburgh 30, Pa.

Data on Welding

The importance of ground current conduction when using welding positioners is discussed in a 13-page booklet. Aronson Machine Co., Arcade, New York.

Surface Equipment

Catalog 839 covers over 300 items. Included are semisteel and granite surface plates, angle plates, V-blocks, box parallels, straight edges, welding tables, and other equipment. Challenge Machinery Co., Grand Haven, Mich.

Strippable Vinyl Coats

A folder describes transparent, high tensile coatings that can be used to protect and moisture seal a variety of metallic and nonmetallic surfaces. The brochure suggests application techniques, stripping, and some of the uses for the product. Metal Processing Dept., Pennsalt Chemicals Corp., 3 Penn Center, Philadelphia 2, Pa.

Rubber-Metal Products

A line of bearings, bushings, couplings, mounts, sleeves, and molded shapes is described in a 12-page catalog. The rubber-metal parts are engineered to accept misalignment, isolate vibration, eliminate lubrication, and cushion shock loads. Dept. A, Clevite Harris Products Inc., Lockwood Rd., Milan, Ohio.

Zinc, Aluminum Coated Tubing

This 6-page folder (P. O. 5558) suggests design uses for special coated steel tubing, describes properties of Zincgrip and Aluminized Steel, types 1 and 2. A gage-decimal thickness conversion table is included. Armco Steel Corp., Product Information Service, Middletown, Ohio.

Insert Tool Holders

Catalog 581 describes a new line of throwaway insert tool holders that eliminates the necessity of a separate chip breaker. The design features a top clamp that is carbide hard faced. Throwaway inserts of carbide, cast alloy, oxide, and high speed steel are also described. Viking Tool Co., 1000 Nichols Rd., Shelton, Conn.

Metal-Clad Switchgear

A 24-page bulletin describes a line of metal-clad switchgear which includes indoor and walk-in outdoor equipment with ratings through 3000 amperes continuous and 350 mva interrupting capacities. Ask for Bulletin 2804-1A. I-T-E Circuit Breaker Co., 1900 Hamilton St., Philadelphia 30, Pa.

Watch Autos, Inventories, USW in '59

January 5, 1959

GET SET for an eventful year in steel. You can expect:

A 30 per cent increase in production and shipments. Output will climb to 110 million ingot tons (vs. 85 million last year) and finished steel shipments to 80 million tons (vs. 61.4 million in 1958).

Greater consumption by the automotive, construction, petroleum, machinery, farm implement, railroad, appliance, and container industries.

Widespread reversal of inventory policy. Consumers will add 4 million tons to their stockpiles before July. (From June, 1957, to September, 1958, they were liquidating. Inventories fell from 23 million tons to 13 million. Current estimate: 14 million.)

Explosive contract talks between the industry and the United Steelworkers. Chances are that agreement on a new pact won't be reached before the old one expires on June 30.

No steel shortages unless consumers panic. The industry's capacity (about 146 million ingot tons) assures good deliveries even at demand peaks. But the combined effects of "normal" inventory replenishment and excessive hedging against a threatened strike could make trouble.

Stable prices through the first half. There may be minor revisions in extras before July, but wholesale adjustments are out of the question. If the USW wins a costly package, base prices may go up sharply in late summer.

AUTOMAKERS OPTIMISTIC— New car sales are expected to jump about 30 per cent this year to 5.5 million. "With the right combination of market factors, they could go as high as 6 million, including about 400,000 imported cars," says L. L. Colbert, president of Chrysler Corp.

Look for the automotive industry to regain its status as steel's No. 1 customer this year, a distinction it hasn't had since 1955. Last year, warehouses and distributors held the top spot, taking 18 per cent of domestic shipments (vs. automakers' 15.6 per cent).

BIG YEAR FOR SHEETS—Aided mostly by the upturn in automotive demand, sheets will also benefit from a 10-15 per cent pickup in appliance sales. Construction may take 15 or 20 per cent more steel as expenditures reach an all-time high (more than $52 billion).

PICKUP FOR BARS— Like sheets, bars will have an expanded automotive market. Increased production of cars and appliances will require more fasteners (made from bars). Shipments to machinery and railroad equipment builders are expected to improve. Mining equipment is on the upgrade, and sales to farm implement makers will continue on a high level.

PLATES WILL GAIN— Greater demand for line pipe and railroad cars will bolster plate shipments this year. Wide plates may soon be in tight supply. Construction requirements will increase moderately, offsetting a decline in shipbuilding needs.

TUBULAR OUTLOOK BRIGHT—Line pipe bookings will improve as gas transmission companies push their expansion programs. Demand for oil country goods will increase as inventories hit bedrock. It's estimated that 53,000 to 55,000 wells will be drilled this year (vs. 49,000 in 1958).

PRODUCTION REBOUNDS— Although New Year's Day operations were somewhat curtailed, the ingot rate climbed 6 points last week to 75 per cent of capacity. Production was about 1,943,000 net tons of steel for ingots and castings.

WHERE TO FIND MARKETS & PRICES

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See Page 115, Dec. 1, 1958 issue for current prices on boiler tubes.

TUBE DISTRIBUTORS BALANCED SERVICE

cuts your steel tubing handling costs!

Fact!...You can cut your steel tubing handling, processing, storage and inventory costs – and still maintain production continuity – *without paying a premium*, when you buy in warehouse quantities.

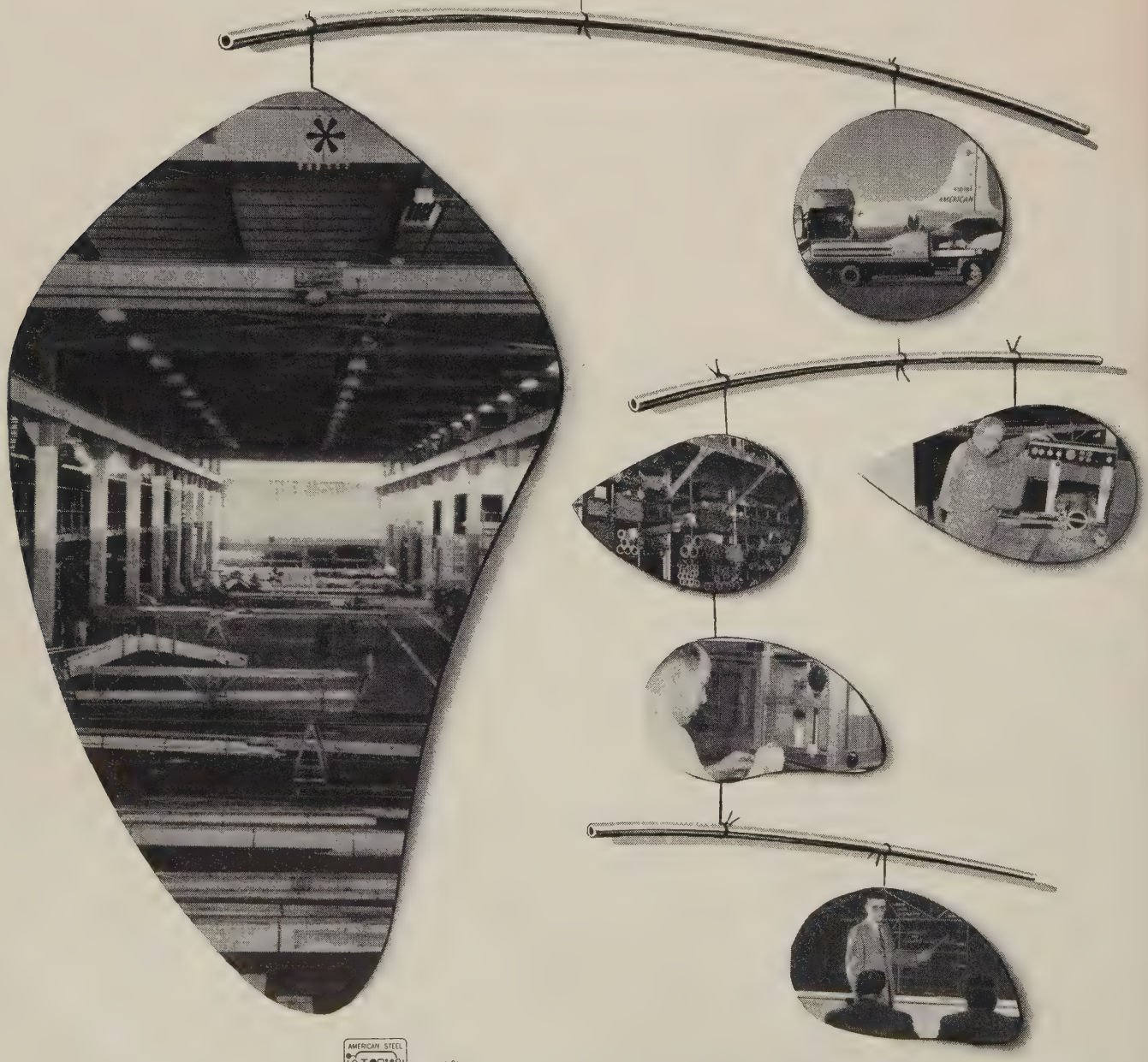
How?...By making full use of TD's "balanced service":

1. Thousands of sizes in all standard types and analyses in stock*.
2. Systematic handling that insures on-time-delivery.
3. Personalized Inventory Plan custom-tailored to your requirements.
4. TD's *complete* quality control program.
5. Extra warehouse services.
6. Technical assistance from steel tubing specialists.

***THOUSANDS OF SIZES IN ALL STANDARD TYPES AND ANALYSES IN STOCK!** TD's warehouse has more than 321 miles of steel tubing on hand. You can virtually be sure of getting what you want right out of stock thereby eliminating your having to "shop-around" for other sources of supply. That goes for hard to get items, also. TD's inventory makes one-call steel tube purchasing a reality.

Call TD for—stainless, alloy and carbon steel tubing, both aircraft and commercial quality.

Write Dept. S13 today for your copy of "Eighteen Ways to Save Money in Your Steel Tubing Purchasing," and the name of your nearest TD representative.



AMERICAN STEEL WAREHOUSE ASS'N

TUBE DISTRIBUTORS CO., INC.

GARDEN CITY NEW YORK

STEEL QUARTERLY SURVEY

COMPONENTS	CURRENT INVENTORIES: UNDER 10 DAYS	10-30 DAYS	30-60 DAYS	60-90 DAYS	3-6 MONTHS	1st Quarter FORECAST: LOWER	SAME	HIGHER
CASTINGS . . . . . Die, gray iron, malleable, nonferrous, steel.	3%	22%	54%	20%	1%	6%	65%	29%
OTHER FORMED COMPONENTS . . . . Forgings, stampings, springs, wire shapes.	2%	18%	50%	22%	8%	7%	64%	29%
MACHINED COMPONENTS . . . . . Bearings, couplings, cylinders, gears, screw machine products.	2%	20%	51%	22%	5%	7%	63%	30%
ELECTRICAL EQUIPMENT, MOTORS . .	6%	34%	39%	16%	5%	7%	68%	25%
FASTENERS	1%	23%	46%	26%	4%	6%	70%	24%
MECHANICAL RUBBER GOODS, BELTING	6%	38%	37%	17%	2%	4%	76%	20%

FIGURES are percentages of respondents to STEEL's quarterly survey. COLOR UNDERSCORED figures show how most respondents reported.

Buyers To Build Component Stocks

Scattered shortages and lengthening delivery times bring an end to inventory reductions. Here's how reversal of 1958 trend may help your firm this quarter

YOU CAN EXPECT to see a major change in inventory policies this quarter. Responses to STEEL's quarterly survey of component buyers show users plan to purchase more than they'll consume in the next three months.

Some 27 per cent of the respondents think their stocks will be higher at the end of March than they were in December, 1958. Only 6 per cent think they'll be lower. Not since first quarter of 1957 has the number of firms predicting a rise in inventories exceeded those expecting a decline.

• **Across the Board**—Significantly, buyers in each component group told STEEL they plan to boost stocks in the next three months. Thirty per cent of machined component buyers look for higher stocks, while 7 per cent predict a cut in supplies. Three months ago (STEEL, Oct. 6, 1958, p. 111), 23 per cent expected inventories to decline, while only 10 per cent predicted increases.

The trend in electrical equipment and motors is equally sweeping. In STEEL's October survey, only 4 per cent of the buyers thought their stocks would increase in the following three months. Twenty-five per cent now predict a gain.

Inventory cutting continued throughout the fourth quarter, respondents indicate. Some 28 per cent of the buyers say they trimmed stocks in final three months of the year. One in ten added to his inventories.

• **Leadtime Lengthens**—Buyers are building up their supplies for two reasons: Slower deliveries and improved sales. Last summer (STEEL, July 7, 1958, p. 95), component buyers reported deliveries were seldom slow. Three months later, they began to complain about lengthening delivery times for several types of components. Now 30 per cent of buyers say they have some trouble getting quick delivery on at least one type of component. Generally, they report spot shortages which cause moderate inconvenience. Only 2 per cent of buyers complain that deliveries are generally inadequate.

Ten per cent of buyers of bearings say deliveries are slower than they would like. Several buyers of electrical equipment and castings

report difficulty in obtaining rapid delivery.

An eastern Pennsylvania buyer complains: "We have run into trouble where a supplier cuts his work force to the bone, and a pick-up in his business delays his deliveries."

• **Surpluses Disappear** — If your firm supplies components, your selling job should be eased this quarter by the absence of oversized inventories. In early third quarter of 1958, 13 per cent of buyers of motors over 5 hp said their inventories were too high. That figure plummeted to zero in STEEL's current survey. In the same period, the proportion of firms buying forgings and reporting an oversupply dropped from 11 per cent to 2 per cent. A handful of buyers of castings, bearings, screw machine products, and fasteners say they have more than desired.

A look at the days of inventory held by buyers shows why many are planning buildups. Most purchasers of most components kept their inventories between 30 and 60 days in 1958. Some buyers have cut stocks well below 30 days. For example, 44 per cent of buyers of mechanical rubber goods and belting have less than 30 day supplies. Four in ten buyers of electrical equipment and motors have under 30 days' inventory. Three months ago, only 3 in 10 were that low.

Sheets, Strip . . .

Sheet & Strip Prices, Pages 449 & 450

"Our sales are booming," a Pittsburgh district sheetmaker reports. "The labor troubles at Chrysler had little effect on our shipments. On hot-rolled products we're booking orders for late January and early February. On cold rolled, we'll soon be full for February."

Although automakers are taking the lion's share of the tonnage, demand is broad based. The appliance and construction industries are placing large orders, and miscellaneous consumers are filling out their inventories.

Last year's stamping shop volume in New England was about 10 per cent below 1957's but most shops are entering first quarter sheet orders in heavier volume, and are planning to supplement them with additional tonnages by March as a hedge against a possible steel strike at midyear.

Galvanized sheets still lead the demand parade, being sold out at some mills through March. Cold-rolled sheets are booked through February.

Shipments of steel shipping barrels and drums in October totaled 2,790,242 units, down 7 per cent from 3,004,070 units shipped in September, and 10 per cent from 3,116,774 units moved in October, 1957, reports the U. S. Bureau of the Census. Shipments in the first ten months were 26,560,416 units, vs. 30,709,419 in the 1957 period.

Wheeling Steel Corp. has started negotiations to purchase the mill equipment and facilities of Follansbee Steel Corp., Follansbee, W. Va. Follansbee operations include rolling mills and metal fabricating shops, but only the mill facilities (which adjoin Wheeling Steel properties) are being considered.

If the purchase is made, Wheel-

ing will be able to move into some new markets and be in position to expand its sheet production. Follansbee Steel would continue terne coating and other operations.

Plates . . .

Plate Prices, Page 448

The market for plates has become noticeably more active since the recent Supreme Court decision in the Memphis gas rate case. Orders are expected to expand early this year.

The spurt in demand that followed the court's decision was for line pipe ordered before the lower court's adverse decision in the Memphis case a year ago, which decision caused many pipeline projects to be suspended. Some of these jobs are now being reactivated, and within the next few months it's expected that a number of new projects will come out for bids.

Charles Lukens Huston Jr., president, Lukens Steel Co., Coatesville, Pa., thinks demand for steel plates will lag behind other products in the first quarter, but he sees a pickup in the second quarter, some easing in the third, and a marked improvement in the fourth quarter.

Rails, Cars . . .

Track Material Prices, Page 451

Railroad business is bound to improve and should give a lift to the market for light plates and structurals. More car and locomotive orders have been placed the last month or so than in the previous six months.

The Chicago & Northwestern Railroad plans to repair and rebuild nearly 8000 freight cars in its Clinton, Iowa, shops in 1959. The $9 million program will begin the first week of January. The shops will be operated at full capacity, and the number of employees will be increased from about 400 to more than 650.

About 4000 of the 6000 boxcars included in the program will be converted from rough cars used for less-than-carload service to Class A cars. Production will average 31 cars daily.

The New York Central System is contemplating the purchase of 15,000 tons of rails for 1959 delivery.

Orders for 6295 domestic freight cars in November were the largest for any month since April, 1957, when 6429 were placed, reports the American Railway Car Institute and the Association of American Railroads in a joint statement. The November total compared with 781 in October and 1070 in November, 1957.

Freight car deliveries during the month totaled 1803, vs. 1591 in October and 7142 in November of last year.

Cars on order and undelivered on Dec. 1 numbered 27,962, vs. 23,670 on Nov. 1, and 59,194 on Dec. 1, 1957.

Ferroalloys . . .

Ferroalloy Prices, Page 458

Five crushed ferroalloys—50 per cent ferrosilicon, standard and medium carbon ferromanganese, silicomanganese, and calcium-silicon—are being offered in preweighed bags (about 50 lb) by Electro Metallurgical Co., a division of Union Carbide Corp., New York. Handling and weighing of loose mate-

rial at the steel mill are eliminated.

Carbo-sil No. 4, a silicon carbide additive for gray and malleable iron cupolas, is being marketed by American Metallurgical Products Co. Inc., Pittsburgh. The 10 and 15 lb units are encased in lacquered steel containers with locked, unsoldered seams. They protect the precrushed material.

Vanadium Corp. of America, New York, recently announced the addition of three new exothermic ferroalloys to its Vancoram product line. It now has five different exothermic types: Thermokrom, ferrochromium; Thermosil, ferrosilicon; Thermokromsil, ferrochrome silicon; Thermovan, ferrovanadium; and Thermocol, ferrocolumbium.

This series of alloys may be used in most types of alloy steels and irons, including constructional alloy steels, low alloy high strength steels, stainless and heat resisting alloys, spring steels, and tool steels. Exothermic ferrocolumbium and ferrovanadium may also be used for small additions to ferrous metals for beneficial effects on grain size.

Pig Iron . . .

Pig Iron Prices, Page 454

While requirements of pig iron and coke are at the best rate in about a year, a higher level of activity is anticipated during this quarter. Foundry operations continue spotty, but the situation is expected to improve gradually as the quarter advances. The strike at the plants of International Harvester has held down foundry iron consumption in the Midwest over the last six or seven weeks.

Mystic foundry pig iron price for the first quarter, 1959, is unchanged at $68, f.o.b. cars, Everett, Mass., plus current differentials for silicon, phosphorus, and manganese.

November Blast Furnace Output Largest in Year

Blast furnace production (pig iron, ferromanganese, and spiegeleisen) totaled 5,946,163 net tons in November, largest monthly output since October, 1957, when 6,519,478 tons were produced, reports the American Iron & Steel Institute. Of the November total, 39,275 tons were ferromanganese and spiegeleisen.

In the preceding month, output

was 5,872,958 tons (36,963, ferromanganese and spiegeleisen); in November, 1957, the total was 5,779,879 tons (68,637, ferromanganese and spiegeleisen).

Production in the first 11 months of this year was 51,691,210 tons, of which 417,951 tons were ferromanganese and spiegeleisen. In the like 1957 period output amounted to 74,059,991 tons, of which 715,904 tons were ferromanganese and spiegeleisen. Production by states during November and the first 11 months:

BLAST FURNACE PRODUCTION STATISTICS
(Net tons)

States:	November, 1958	First 11 Months, 1958
Massachusetts, New York	361,847	3,268,930
Pennsylvania	1,491,588	13,395,990
Maryland, Virginia, West Virginia	518,783	5,404,246
Kentucky, Tennessee, Texas	144,703	1,421,085
Alabama	314,667	3,063,286
Ohio	1,112,374	8,587,323
Indiana	779,353	6,953,318
Illinois	501,755	3,697,110
Michigan, Minnesota	423,389	2,894,116
Colorado, Utah, California	297,204	3,005,806
Totals	5,946,163*	51,691,610**

*Includes 39,275 tons of ferromanganese and spiegeleisen.
**Includes 417,951 tons of ferromanganese and spiegeleisen.
Data from American Iron & Steel Institute.

Steel Bars . . .

Bar Prices, Page 448

Although demand for carbon steel bars is holding up well, there are open spaces in first quarter order books. Reason: Capacity is greater than it was a year ago, and with relatively prompt shipments available, consumers are inclined to hold down forward orders.

In some consuming areas, New England for example, demand for carbon and alloy bars is not keeping pace with the upturn in flat-rolled steel buying. Consumers have low inventories, and they are depending largely on prompt shipment tonnage. Some forward covering by late first quarter is likely.

Stainless Steel . . .

Stainless Steel Prices, Page 452

Demand for stainless steel bars is more active for January and February shipment. Automotive requirements are heavier, notably in flat-rolled items.

The recent increase in bar and wire prices by one leading producer has not been generally followed by other mills, but indica-

tions are the higher prices will stick.

Grade 430 for automobile trim and parts is in stronger demand with makers reporting more orders on books for January and February delivery.

Crucible Steel Co. of America is withdrawing from the stainless welding electrode business. It is continuing to make and sell stainless core wire for electrode manufacturers and spooled and layer-wound wire to makers of welding equipment.

Reinforcing Bars . . .

Reinforcing Bar Prices, Page 449

The outlook for reinforcing steel demand in 1959 is bright. In the Midwest, Illinois is expected to spend $300 million on highway construction, of which $190 million is anticipated in grants from the federal government. Contracts awarded in 1958 totaled $295 million.

Indiana is planning a record breaking $156 million program which will provide more road expansion in a single year than in all four years of any previous administration. The total allocation exceeds the 1958 record by $4 million.

Bids are in on 8510 tons of reinforcing bars required for drydock No. 6 at the Puget Sound (Wash.) Navy yard. Bids will be opened soon for 1165 tons required in construction of the Seattle freeway bridge. In January, Seattle's Tolt River water supply dam and supply line will require 1600 tons.

Tin Plate . . .

Tin Plate Prices, Page 450

Youngstown Sheet & Tube Co. will expand its tin plate facilities with a second continuous annealing line at its No. 2 tin mill at its Indiana Harbor Works, East Chicago, Ind. Construction will start this year, will be completed in 1960.

Tubular Goods . . .

Tubular Goods Prices, Page 452

Demand for oil country goods has improved in recent weeks, reflecting increasing well drilling operations. In the week ended Dec. 15, there were 901 rigs operating in Texas, vs. 1073 in the like 1957 week, shows a Hughes Tool Co. survey. For the nation, the count was 2321 active rigs, 231 less than in the same week of 1957.

Texas oil production in January will be on a 12-day producing schedule, with the daily allowable holding at the December level.

Steel Ingot Production Declines in November

Production of ingots and steel for castings amounted to 8,549,068 net tons in November, reports the American Iron & Steel Institute. Of the total, 7,843,278 tons were carbon steel; 610,413 tons, alloy steel; and 95,647 tons, stainless and heat resisting steel.

In the preceding month output totaled 8,817,778 tons (8,057,216 tons, carbon steel; 640,242 tons, alloy; 120,320 tons, stainless and heat resisting). Production in November, 1957, was 8,392,919 tons (6,674,064 tons, carbon steel; 673,745 tons, alloy; 1,045,110 tons, carbon, hot topped ingots).

Output in the first 11 months this year totaled 76,436,113 net tons, vs. 105,294,711 tons in the corresponding 1957 period. Production by states for November and the first 11 months:

STEEL PRODUCTION STATISTICS
(Net tons)

States:	November, 1958	First 11 Months, 1958
Massachusetts, Rhode Island, and Connecticut	10,287	149,157
New York	425,776	3,597,790
Pennsylvania	2,007,837	18,836,055
New Jersey, Delaware, and Maryland	531,519	5,778,215
Virginia, W. Virginia, Kentucky, and Tennessee	383,163	3,548,620
Georgia, Alabama, Mississippi	293,054	3,181,036
Ohio	1,514,634	12,291,130
Indiana	1,270,158	11,284,549
Illinois	723,302	6,237,633
Michigan, Minnesota	632,039	4,391,779
Missouri, Oklahoma, Texas, and Colorado	307,100	3,003,318
Utah, Washington, Oregon	196,675	1,856,014
California	253,524	2,280,817
Totals	8,549,068	76,436,113
Tonnage lost by work stoppages	20,500	125,600

Data from the American Iron & Steel Institute.

Distributors . . .

Prices, Page 454

Distributors generally expect a pickup in order volume this month. Some think first quarter business will show a sizable gain over that in the fourth quarter of 1958. Demand for automotive steel is likely to increase, and a seasonal rise in construction steel requirements is anticipated before the quarter ends.

DISTRICT INGOT RATES
(Percentage of Capacity Engaged)

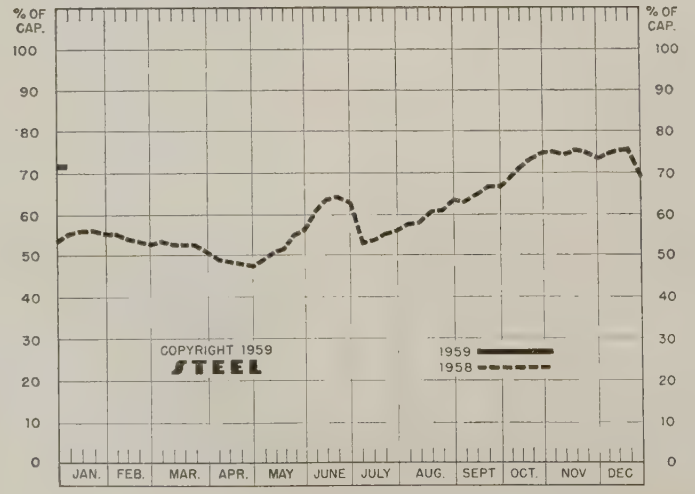
	Week Ended Jan. 4	Change	Same Week 1958	Same Week 1957
Pittsburgh	64	+ 9*†	51	100
Chicago	87	+ 0.5*	67.5	100
Eastern	71	+14	80	102
Youngstown	64	+14	48	104
Wheeling	75	+ 4†	54.5	99
Cleveland	73	+ 7	57.5	93
Buffalo	66	0	56	107.5
Birmingham	73	+ 1.5†	71.5	94.5
Cincinnati	83	— 5*	65	94.5
St. Louis	96	+23	74	84
Detroit	101	+12*	73.5	103
Western	79.5	+ 0.5†	77	103
National Rate	75†	+ 6	55	98

INGOT PRODUCTION‡

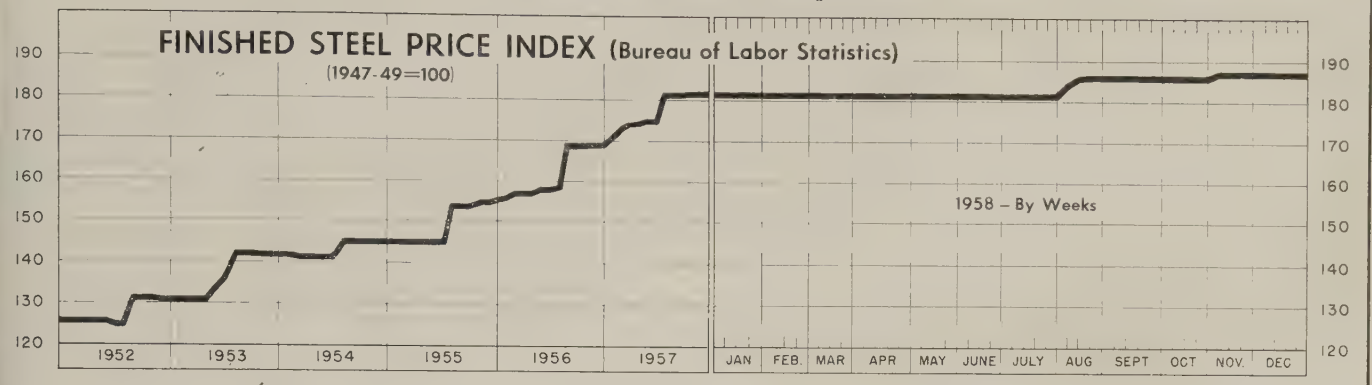
	Week Ended Jan. 4	Week Ago	Month Ago	Year Ago
INDEX (1947-49=100)	127.3	114.5	123.6	93.4
NET TONS (In thousands)	2,045	1,840	1,985	1,501

*Change from preceding week's revised rate. †Estimated. ‡American Iron & Steel Institute. Weekly capacity (net tons): 2,699,173 in 1958; 2,559,490 in 1957; 2,461,893 in 1956.

NATIONAL STEELWORKS OPERATIONS



Price Indexes and Composites



Dec. 30, 1958	Week Ago	Month Ago	Nov. Avg	Year Ago
187.4†	187.4	187.4	187.4	181.7

†Preliminary

AVERAGE PRICES OF STEEL (Bureau of Labor Statistics)

Week Edned Dec. 30

Prices include mill base prices and typical extras and deductions. Units are 100 lb except where otherwise noted in parentheses. For complete description of the following products and extras and deductions applicable to them, write to STEEL.

Rails, Standard No. 1	$5.825	Bars, Reinforcing	6.385
Rails, Light, 40 lb	7.292	Bars, C.F., Carbon	10.710
Tie Plates	6.875	Bars, C.F., Alloy	14.125
Axles, Railway	10.175	Bars, C.F., Stainless, 302 (lb)	0.553
Wheels, Freight Car, 33 in. (per wheel)	62.000	Sheets, H.R., Carbon	6.350
Plates, Carbon	6.350	Sheets, C.R., Carbon	7.300
Structural Shapes	6.167	Sheets, Galvanized	8.695
Bars, Tool Steel, Carbon (lb)	0.560	Sheets, C.R., Stainless, 302 (lb)	0.688
Bars, Tool Steel, Alloy, Oil Hardening Die (lb)	0.680	Sheets, Electrical	12.625
Bars, Tool Steel, H.R., Alloy, High Speed, W 6.75, Cr 4.5, V 2.1, Mo 5.5, C 0.060 (lb)	1.400	Strip, C.R., Carbon	9.489
Bars, Tool Steel, H.R., Alloy, High Speed, W18, Cr 4, V 1 (lb)	1.895	Strip, C.R., Stainless, 430 (lb)	0.493
Bars, H.R., Alloy	10.775	Strip, H.R., Carbon	6.250
Bars, H.R., Stainless, 303 (lb)	0.525	Pipe, Black, Buttweld (100 ft)	20.525
Bars, H.R., Carbon	6.675	Pipe, Galv., Buttweld (100 ft)	24.315
		Pipe, Line (100 ft)	205.710
		Casing, Oil Well, Carbon (100 ft)	201.080
		Casing, Oil Well, Alloy (100 ft)	315.213
Tubes, Boiler (100 ft)	51.200	Black Plate, Canmaking Quality (95 lb base box)	7.900
Tubing, Mechanical, Carbon (100 ft)	26.157	Wire, Drawn, Carbon	10.575
Tubing, Mechanical, Stainless, 304 (100 ft)	205.608	Wire, Drawn, Stainless, 430 (lb)	0.653
Tin Plate, Hot-dipped, 1.25 lb (95 lb base box)	10.100	Bale Ties (bundles)	7.967
Tin Plate, Electrolytic, 0.25 lb (95 lb base box)	8.800	Nails, Wire, 8d Common.	9.828
		Wire, Barbed (80-rod spool)	8.719
		Woven Wire Fence (20-rod roll)	21.737

STEEL's FINISHED STEEL PRICE INDEX*

	Dec. 31 1958	Week Ago	Month Ago	Year Ago	5 Yr Ago
Index (1935-39 avg=100)	247.82	247.82	247.82	239.15	189.74
Index in cents per lb	6.713	6.713	6.713	6.479	5.140

STEEL's ARITHMETICAL COMPOSITES*

Finished Steel, NT	$149.96	$149.96	$149.96	$145.42	$114.64
No. 2 Fdry Pig Iron, GT	66.49	66.49	66.49	66.49	56.54
Basic Pig Iron, GT	65.99	65.99	65.99	65.99	56.04
Malleable Pig Iron, GT	67.27	67.27	67.27	67.27	57.27
Steelmaking Scrap, GT	39.66	39.66	45.50	33.17	31.33

*For explanation of weighted index see STEEL, Sept. 19, 1949, p. 54; of arithmetical price composite, STEEL, Sept. 1, 1952, p. 130.

Comparison of Prices

Comparative prices by districts in cents per pound except as otherwise noted. Delivered prices based on nearest production point.

FINISHED STEEL

	Dec. 31 1958	Week Ago	Month Ago	Year Ago	5 Yr Ago
Bars, H.R., Pittsburgh	5.675	5.675	5.675	5.425	4.15
Bars, H.R., Chicago	5.675	5.675	5.675	5.425	4.15
Bars, H.R., deld. Philadelphia	5.975	5.975	5.975	5.725	5.302
Bars, C.F., Pittsburgh	7.65*	7.65*	7.65*	7.30*	5.20
Shapes, Std., Pittsburgh	5.50	5.50	5.50	5.275	4.10
Shapes, Std., Chicago	5.50	5.50	5.50	5.275	4.10
Shapes, deld., Philadelphia	5.77	5.77	5.77	5.545	4.38
Plates, Pittsburgh	5.30	5.30	5.30	5.10	4.10
Plates, Chicago	5.30	5.30	5.30	5.10	4.10
Plates, Coatesville, Pa.	5.30	5.30	5.30	5.10	4.35
Plates, Sparrows Point, Md.	5.30	5.30	5.30	5.10	4.10
Plates, Claymont, Deld.	5.30	5.30	5.30	5.70	4.55
Sheets, H.R., Pittsburgh	5.10	5.10	5.10	4.925	3.925
Sheets, H.R., Chicago	5.10	5.10	5.10	4.925	3.925
Sheets, C.R., Pittsburgh	6.275	6.275	6.275	6.05	4.775
Sheets, C.R., Chicago	6.275	6.275	6.275	6.05	4.775
Sheets, C.R., Detroit	6.275	6.275	6.275	6.05-6.15	4.975
Sheets, Galv., Pittsburgh	6.875	6.875	6.875	6.60	5.275
Strip, H.R., Pittsburgh	5.10	5.10	5.10	4.925	4.425
Strip, H.R., Chicago	5.10	5.10	5.10	4.925	3.925
Strip, C.R., Pittsburgh	7.425	7.425	7.425	7.15	5.45
Strip, C.R., Chicago	7.425	7.425	7.425	7.15	5.70
Strip, C.R., Detroit	7.425	7.425	7.425	7.25	5.45-6.05
Wire, Basic, Pittsburgh	8.00	8.00	8.00	7.65	5.525
Nails, Wire, Pittsburgh	8.95	8.95	8.95	8.95	6.55
Tin plate (1.50 lb) box, Pitts.	$10.65	$10.65	$10.65	$10.30	$8.95

*Including 0.35c for special quality.

SEMIFINISHED STEEL

Billets, forging, Pitts. (NT)	$99.50	$99.50	$99.50	$96.00	$75.50
Wire rods 7/32-5/8" Pitts.	6.40	6.40	6.40	6.15	4.525

PIG IRON, Gross Ton

	Dec. 31 1958	Week Ago	Month Ago	Year Ago	5 Yr Ago
Bessemer, Pitts.	$67.00	$67.00	$67.00	$67.00	$57.00
Basic, Valley	66.00	66.00	66.00	66.00	56.00
Basic, deld., Phila.	70.41	70.41	70.41	70.01	60.75
No. 2 Fdry, NevilleIsland,Pa.	66.50	66.50	66.50	66.50	56.50
No. 2 Fdry, Chicago	66.50	66.50	66.50	66.50	56.50
No. 2 Fdry, deld., Phila.	70.91	70.91	70.91	70.51	61.25
No. 2 Fdry, Birm.	62.50	62.50	62.50	62.50	52.88
No. 2 Fdry(Birm.)deld. Cin.	70.20	70.20	70.20	70.20	60.43
Malleable, Valley	66.50	66.50	66.50	66.50	56.50
Malleable, Chicago	66.50	66.50	66.50	66.50	56.50
Ferromanganese, net ton†	245.00	245.00	245.00	245.00	200.00

†74-76% Mn, Duquesne, Pa.

SCRAP, Gross Ton (Including broker's commission)

No. 1 Heavy Melt, Pittsburgh	$42.50	$41.50	$41.50	$31.50	$32.50
No. 1 Heavy Melt, E. Pa.	34.00	34.00	35.00	37.00	29.50
No. 1 Heavy Melt, Chicago.	42.50	42.00	42.50	31.00	30.50
No. 1 Heavy Melt, Valley	42.50	42.50	42.50	29.50	29.50
No. 1 Heavy Melt, Cleve.	39.00	39.00	39.00	26.50	28.50
No. 1 Heavy Melt, Buffalo.	33.50	33.50	33.50	30.50	29.50
Rails, Rerolling, Chicago	62.50	62.50	63.50	49.50	42.50
No. 1 Cast, Chicago	45.50	45.50	45.50	38.50	32.50

COKE, Net Ton

Beehive, Furn., Connlsvl.	$15.25	$15.25	$15.25	$15.25	$14.75
Beehive, Fdry., Connlsvl.	18.25	18.25	18.25	18.25	16.75
Oven, Fdry., Milwaukee	30.50	30.50	30.50	30.50	25.25

Steel Prices

Mill prices as reported to STEEL, Dec. 31, cents per pound except as otherwise noted. Changes shown in italics. Code number following mill points indicates producing company. Key to producers, page 449, footnotes, page 451.

SEMIFINISHED

INGOTS, Carbon, Forging (NT)
Munhall,Pa. U5 ....$76.00

INGOTS, Alloy (NT)
Detroit S41 .....$82.00
Economy,Pa. B14 ....82.00
Farrell,Pa. S3 .....82.00
Lowellville,O. S3 ....82.00
Midland,Pa. C18 .....82.00
Munhall,Pa. U5 .....82.00
Sharon,Pa. S3 .....82.00

BILLETS, BLOOMS & SLABS
Carbon, Rerolling (NT)
Bartonville,Ill. K4 ....$82.00
Bessemer,Pa. U5 .....80.00
Buffalo R2 .....80.00
Clairton,Pa. U5 .....80.00
Ensley,Ala. T2 .....80.00
Fairfield,Ala. T2 ....80.00
Fontana,Calif. K1 ....90.50
Gary,Ind. U5 .....80.00
Johnstown,Pa. B3 ....80.00
Lackawanna,N.Y. B2..80.00
Munhall,Pa. U5 ....80.00
Owensboro,Ky. G8 ....80.00
S.Chicago,Ill. R2, U5 .80.00
S.Duquesne,Pa. U5 ....80.00
Sterling,Ill. N15 ....80.00
Youngstown R2 .....80.00

Carbon, Forging (NT)
Bessemer,Pa. U5 ....$99.50
Buffalo R2 .....99.50
Canton,O. R2 .....102.00
Clairton,Pa. U5 .....99.50
Conshohocken,Pa. A3..104.50
Ensley,Ala. T2 .....99.50
Fairfield,Ala. T2 .....99.50
Farrell,Pa. S3 .....99.50
Fontana,Calif. K1 ....109.00
Gary,Ind. U5 .....99.50
Geneva,Utah C11 .....99.50
Houston S5 .....101.50
Johnstown,Pa. B2 ....99 50
Lackawanna,N.Y. B2 ..99.50
LosAngeles B3 .....109.00
Midland,Pa. C18 .....99.50
Munhall,Pa. U5 .....99.50
Owensboro,Ky. G8 ....99.50
Seattle B3 .....113.00
Sharon,Pa. S3 .....99.50
S.Chicago R2, U5, W14.99.50
S.Duquesne,Pa. U5 ....99.50
S.SanFrancisco B3 ....109.00
Warren,O. C17 .....99.50

Alloy, Forging (NT)
Bethlehem,Pa. B2 ..$119.00
Bridgeport,Conn. C32 .119.00
Buffalo R2 .....119.00
Canton,O. R2, T7 ....119.00
Conshohocken,Pa. A3..126.00
Detroit S41 .....119.00
Economy,Pa. B14 ....119.00
Farrell,Pa. S3 .....119.00
Fontana,Calif. K1 ....140.00
Gary,Ind. U5 .....119 00
Houston S5 .....124.00
Ind.Harbor,Ind. Y1 ..119.00
Johnstown,Pa. B2 ....119.00
Lackawanna,N.Y. B2..119.00
LosAngeles B3 .....139.00
Lowellville,O. S3 ....119.00
Massillon,O. R2 .....119.00
Midland,Pa. C18 .....119.00
Munhall,Pa. U5 .....119.00
Owensboro,Ky. G8 ....119.00
Sharon,Pa. S3 .....119.00
S.Chicago R2,U5,W14.119.00
S.Duquesne,Pa. U5 ..119.00
Struthers,O. Y1 .....119.00
Warren,O. C17 .....119.00

ROUNDS, SEAMLESS TUBE (NT)
Buffalo R2 .....$122.50
Canton,O. R2 .....125.00
Cleveland R2 .....122.50
Gary,Ind. U5 .....122.50
S.Chicago,Ill. R2, W14 122.50
S.Duquesne,Pa. U5 ..122.50
Warren,O. C17 .....122.50

SKELP
Aliquippa,Pa. J5 .....5.05
Munhall,Pa. U5 .....5.05
Pittsburgh J5 .....5.05
Warren,O. R2 .....5.05
Youngstown R2, U5 ....5.05

WIRE RODS
AlabamaCity,Ala. R2 ..6.40
Aliquippa,Pa. J5 .....6.40
Alton,Ill. L1 .....6.60
Bartonville,Ill. K4 .....6.50
Buffalo W12 .....6.40
Cleveland A7 .....6.40
Donora,Pa. A7 .....6.40
Fairfield,Ala. T2 .....6.40
Houston S5 .....6.65
IndianaHarbor,Ind. Y1..6.40
Johnstown,Pa. B2 ....6.40
Joliet,Ill. A7 .....6.40
KansasCity,Mo. S5 ....6.65
Kokomo,Ind. C16 .....6.50
LosAngeles B3 .....7.20
Minnequa,Colo. C10 ....6.65
Monessen,Pa. P7 .....6.40
N. Tonawanda,N.Y. B11.6.40
Pittsburg,Calif. C11 ....7.20
Portsmouth,O. P12 ....6.40
Roebling,N.J. R5 .....6.50
S.Chicago,Ill. R2, W14..6.40
SparrowsPoint,Md. B2 ..6.50
Sterling,Ill.(1) N15 ....6.40
Sterling,Ill. N15 .....6.50
Struthers,O. Y1 .....6.40
Worcester,Mass. A7 ....6.70

STRUCTURALS

Carbon Steel Std. Shapes
AlabamaCity,Ala. R2 ..5.50
Aliquippa,Pa. J5 .....5.50
Atlanta A11 .....5.70
Bessemer,Ala. T2 .....5.50
Bethlehem,Pa. B2 .....5.55
Birmingham C15 .....5.50
Clairton,Pa. U5 .....5.50
Fairfield,Ala. T2 .....5.50
Fontana,Calif. K1 ....6.30
Gary,Ind. U5 .....5.50
Geneva,Utah C11 .....5.50
Houston S5 .....5.60
Ind.Harbor,Ind. I-2, Y1.5.50
Johnstown,Pa. B2 .....5.55
Joliet,Ill. P22 .....5.50
KansasCity,Mo. S5 ....5.60
Lackawanna,N.Y. B2 ..5.55
LosAngeles B3 .....6.20
Minnequa,Colo. C10 ....5.80
Munhall,Pa. U5 .....5.50
Niles,Calif. P1 .....6.25
Phoenixville,Pa. P4 ....5.55
Portland,Oreg. O4 .....6.25
Seattle B3 .....6.25
S.Chicago,Ill. U5, W14..5.50
S.SanFrancisco B3 ....6.15
Sterling,Ill. N15 .....5.50
Torrance,Calif. C11 ....6.20
Weirton,W.Va. W6 ....5.50

Wide Flange
Bethlehem,Pa. B2 .....5.55
Clairton,Pa. U5 .....5.50
Fontana,Calif. K1 .....6.45
IndianaHarbor,Ind. I-2..5.50
Lackawanna,N.Y. B2 ..5.55
Munhall,Pa. U5 .....5.50
Phoenixville,Pa. P4 ....5.55
S Chicago,Ill. U5 .....5.50
Weirton,W.Va. W6 .....5.50

Alloy Std. Shapes
Aliquippa,Pa. J5 .....6.80
Clairton,Pa. U5 .....6.80
Gary,Ind. U5 .....6.80
Houston S5 .....6.90
Munhall,Pa. U5 .....6.80
S.Chicago,Ill. U5, W144..6.80

H.S., L.A. Std. Shapes
Aliquippa,Pa. J5 .....8.05
Bessemer,Ala. T2 .....8.05
Bethlehem,Pa. B2 .....8.10
Clairton,Pa. U5 .....8.05
Fairfield,Ala. T2 .....8.05
Fontana,Calif. K1 .....8.85
Gary,Ind. U5 .....8.05
Geneva,Utah C11 .....8.05
Houston S5 .....8.15
Ind.Harbor,Ind. I-2, Y1.8.05
Johnstown,Pa. B2 .....8.10
KansasCity,Mo. S5 .....8.15
Lackawanna,N.Y. B2 ..8.10
LosAngeles B3 .....8.75
Munhall,Pa. U5 .....8.05
Seattle B3 .....8.80
S.Chicago,Ill. U5, W14..8.05
S SanFrancisco B3 ....8.70
Struthers,O. Y1 .....8.05

H.S., L.A. Wide Flange
Bethlehem,Pa. B2 .....8.10
Ind.Harbor,Ind. I-2 ....8.05
Lackawanna,N.Y. B2 ..8.10
Munhall,Pa. U5 .....8.05
S.Chicago,Ill. U5 .....8.05

PILING

BEARING PILES
Bethlehem,Pa. B2 .....5.55
Ind.Harbor,Ind. I-2 ....5.50
Lackawanna,N.Y. B2 ..5.55
Munhall,Pa. U5 .....5.50
S.Chicago,Ill. I-2, U5 ..5.50

STEEL SHEET PILING
Ind.Harbor,Ind. I-2 ....6.50
Lackawanna,N.Y. B2 ..6.50
Munhall,Pa. U5 .....6.50
S.Chicago,Ill. I-2, U5 ..6.50
Weirton,W.Va. W6 ....6.50

PLATES

PLATES, Carbon Steel
AlabamaCity,Ala. R2 ..5.30
Aliquippa,Pa. J5 .....5.30
Ashland,Ky.(15) A10 ...5.30
Atlanta A11 .....5.50
Bessemer,Ala. T2 .....5.30
Clairton,Pa. U5 .....5.30
Claymont,Del. C22 5,30
Cleveland J5, R2 .....5.30
Coatesville,Pa. L7 .....5.30
Conshohocken,Pa. A3 ..5.30
Ecorse,Mich. G5 .....5.30
Fairfield,Ala. T2 .....5.30
Farrell,Pa. S3 .....5.30
Fontana,Calif.(30) K1 ..6.10
Gary,Ind. U5 .....5.30
Geneva,Utah C11 .....5.30
GraniteCity,Ill. G4 ....5.40
Harrisburg,Pa. P4 .....5.30
Houston S5 .....5.40
Ind.Harbor,Ind. I-2, Y1.5.30
Johnstown,Pa. B2 .....5.30
Lackawanna,N.Y. B2 ..5.30
Mansfield,O. E6 .....5.30
Minnequa,Colo. C10 ....6.15
Munhall,Pa. U5 .....5.30
Newport,Ky. A2 .....5.30
Pittsburgh J5 .....5.30
Riverdale,Ill. A1 .....5.30
Seattle B3 .....6.20
Sharon,Pa. S3 .....5.30
S.Chicago,Ill. U5, W14..5.30
SparrowsPoint,Md. B2 ..5.30
Sterling,Ill. N15.. .....5.30
Steubenville,O. W10 ....5.30
Warren,O. R2 .....5.30
Youngstown U5, Y1 ....5.30
Youngstown(27) R2 ....5.30

PLATES, Carbon Abras. Resist.
Claymont,Del. C22 ....7.05
Fontana,Calif. K1 .....7.85
Geneva,Utah C11 .....7.05
Houston S5 .....7.15
Johnstown,Pa. B2 .....7.05
SparrowsPoint,Md. B2 ..7.05

PLATES, Wrought Iron
Economy,Pa. B14 ....13.55

PLATES, H.S., L.A.
Aliquippa,Pa. J5 .....7.95
Ashland,Ky. A10 .....7.95
Bessemer,Ala. T2 .....7.95
Clairton,Pa. U5 .....7.95
Claymont,Del. C22 .....7.95
Cleveland J5, R2 .....7.95
Coatesville,Pa. L7 .....7.95
Conshohocken,Pa. A3 ..7.95
Economy,Pa. B14 .....7.95
Ecorse,Mich. G5 .....7.95
Fairfield,Ala. T2 .....7.95
Farrell,Pa. S3 .....7.95
Fontana,Calif.(30) K1 ..8.75
Gary,Ind. U5 .....7.95
Geneva,Utah C11 .....7.95
Houston S5 .....8.05
Ind.Harbor,Ind. I-2, Y1.7.95
Johnstown,Pa. B2 .....7.95
Munhall,Pa. U5 .....7.95
Pittsburgh J5 .....7.95
Seattle B3 .....8.85
Sharon,Pa. S3 .....7.95
S.Chicago,Ill. U5, W14..7.95
SparrowsPoint,Md. B2 ..7.95
Warren,O. R2 .....7.95
Youngstown U5, Y1 ....7.95

PLATES, ALLOY
Aliquippa,Pa. J5 .....7.50
Claymont,Del. C22 .....7.50
Coatesville,Pa. L17 .....7.50
Economy,Pa. B14 .....7.50
Farrell,Pa. S3 .....7.50
Fontana,Calif. K1 .....8.30
Gary,Ind. U5 .....7.50
Houston S5 .....7.60
Ind.Harbor,Ind. Y1 ....7.50
Johnstown,Pa. B2 .....7.50
Lowellville,O. S3 .....7.50
Munhall,Pa. U5 .....7.50
Newport,Ky. A2 .....7.50
Pittsburgh J5 .....7.50
Seattle B3 .....8.40
Sharon,Pa. S3 .....7.50
S.Chicago,Ill. U5, W14..7.50
SparrowsPoint,Md. B2 ..7.50
Youngstown Y1 .....7.50

FLOOR PLATES
Cleveland J5 .....6.375
Conshohocken,Pa. A3 ..6.375
Ind.Harbor,Ind. I-2 ....6.375
Munhall,Pa. U5 .....6.375
Pittsburgh J5 .....6.375
S.Chicago,Ill. U5 .....6.375

PLATES, Ingot Iron
Ashland c.l.(15) A10 ..5.55
Ashland l.c.l.(15) A10 ..6.05
Cleveland c.l. R2 .....6.05
Warren,O. c.l. R2 .....6.05

BARS

BARS, Hot-Rolled Carbon (Merchant Quality)
Ala.City,Ala.(9) R2 N5.675
Aliquippa,Pa.(9) J5 ..5.675
Alton,Ill. L1 .....5.875
Atlanta(9) A11 .....5.875
Bessemer,Ala.(9) T2 ..5.675
Birmingham(9) C15 ..5.675
Buffalo(9) R2 .....5.675
Canton,O.(23) R2 .....6.15
Clairton,Pa.(9) U5 ....5.675
Cleveland(9) R2 .....5.675
Ecorse,Mich.(9) G5 ..5.675
Emeryville,Calif. J7 ...6.425
Fairfield,Ala.(9) T2 ..5.675
Fairless,Pa.(9) U5 ....5.825
Fontana,Calif.(9) K1 ..6.375
Gary,Ind.(9) U5 .....5.675
Houston(9) S5 .....5.925
Ind.Harbor(9) I-2, Y1.5.675
Johnstown,Pa.(9) B2 ..5.675
Joliet,Ill. P22 .....5.675
KansasCity,Mo.(9) S5 .5.925
Lackawanna(9) B2 ....5.675
LosAngeles(9) B3 ....6.375
Massillon,O. (23) R2...6.15
Midland,Pa.(23) C18 ..6.025
Milton,Pa. M18 .....5.825
Minnequa,Colo. C10 ...6.125
Niles,Calif. P1 .....6.375
N.T'wan'a,N.Y.(23)B11 6.025
Owensboro,Ky.(9) G8 ..6.025
Pittsburg,Calif.(9) C11.6.375
Pittsburgh(9) J5 .....5.675
Portland,Oreg. O4 .....6.425
Riverdale,Ill.(9) A1 ..5.675
Seattle B3, N14 .....6.425
S.Ch'c'go(9)R2,U5,W14 5.675
S.Duquesne,Pa.(9) U5..5.675
S.SanFran.,Calif.(9) B3 6.425
Sterling,Ill.(1)(9) N15..5.675
Sterling,Ill.(9) N15 ....5.775
Struthers,O.(9) Y1 .....5.675
Tonawanda,N.Y. B12 ..5.675
Torrance,Calif.(9) C11.6.375
Warren,O. C17 .....6.025
Youngstown(9) R2, U5.5.675

BARS, Hot-Rolled Alloy
Aliquippa,Pa. J5 .....6.725
Bethlehem,Pa. B2 .....6.725
Bridgeport,Conn. C32 ..6.80
Buffalo R2 .....6.725
Canton,O. R2, T7 .....6.725
Clairton,Pa. U5 .....6.725
Detroit S41 .....6.725
Economy,Pa. B14 .....6.725
Ecorse,Mich. G5 .....6.725
Fairless,Pa. U5 .....6.875
Farrell,Pa. S3 .....6.725
Fontana,Calif. K1 .....7.775
Gary,Ind. U5 .....6.725
Houston S5 .....6.975
Ind.Harbor,Ind. I-2, Y1.6.725
Johnstown,Pa. B2 .....6.725
KansasCity,Mo. S5 .....6.975
Lackawanna,N.Y. B2..6.725
LosAngeles B3 .....7.775
Lowellville,O. S3 .....6.725
Massillon,O. R2 .....6.725
Midland,Pa. C18 .....6.725
Owensboro,Ky. G8 .....6.725
Pittsburgh J5 .....6.725
Sharon,Pa. S3 .....6.725
S.Chicago R2, U5, W14 6.725
S.Duquesne,Pa. U5 .....6.725
Struthers,O. Y1 .....6.725
Warren,O. C17 .....6.725
Youngstown U5 .....6.725

BARS & SMALL SHAPES, H.R. High-Strength, Low-Alloy
Aliquippa,Pa. J5 .....8.30
Bessemer,Ala. T2 .....8.30
Bethlehem,Pa. B2 .....8.30
Clairton,Pa. U5 .....8.30
Cleveland R2 .....8.30
Ecorse,Mich. G5 .....8.30
Fairfield,Ala. T2 .....8.30
Fontana,Calif. K1 .....9.00
Gary,Ind. U5 .....8.30
Houston S5 .....8.55
Ind.Harbor,Ind. Y1 ....8.30
Johnstown,Pa. B2 .....8.30
KansasCity,Mo. S5 .....8.55
Lackawanna,N.Y. B2 ..8.30
LosAngeles B3 .....9.00
Pittsburgh J5 .....8.30
Seattle B3 .....9.05
S.Chicago,Ill. R2, W14..8.30
S.Duquesne,Pa. U5 .....8.30
S.SanFrancisco B3 .....9.05
Struthers,O. Y1 .....8.30
Youngstown U5 .....8.30

BAR SIZE ANGLES; H.R. Carbon
Bethlehem,Pa.(9) B2 ..5.825
Houston(9) S5 .....5.925
KansasCity,Mo.(9) S5..5.925
Lackawanna(9) B2 ...5.675
Sterling,Ill. N15 .....5.775
Sterling,Ill.(1) N15 ...5.675
Tonawanda,N.Y. B12 ..5.675

BAR SIZE ANGLES; S. Shapes
Aliquippa,Pa. J5 .....5.675
Atlanta A11 .....5.875
Joliet,Ill. P22 .....5.675
Minnequa,Colo. C10 ..6.125
Niles,Calif. P1 .....6.375
Pittsburgh J5 .....5.675
Portland,Oreg. O4 .....6.425
SanFrancisco S7 .....6.52
Seattle B3 .....6.425

BAR SHAPES, Hot-Rolled Alloy
Aliquippa,Pa. J5 .....6.80
Clairton,Pa. U5 .....6.80
Gary,Ind. U5 .....6.80
Houston S5 .....7.05
KansasCity,Mo. S5 ....7.05
Pittsburgh J5 .....6.80
Youngstown U5 .....6.80

BARS, C.F. Leaded (Including leaded extra)

Carbon
LosAngeles P2, S30 ..11.75*

Alloy
Ambridge,Pa. W18 ..10.175
BeaverFalls,Pa. M12 ..10.175
Camden,N.J. P13 ....10.35
Chicago W18 .....10.175
Elyria,O. W8 .....10.175
Monaca,Pa. S17 ....10.175
Newark,N.J. W18 ....10.35
SpringCity,Pa. K3 ....10.35

*Grade A; add 0.050c for Grade B.

BARS, Cold-Finished Carbon
Ambridge,Pa. W18 ....7.65
BeaverFalls,Pa. M12,R2.7.65
Birmingham C15 .....8.25
Buffalo B5 .....7.70
Camden,N.J. P13 ....8.10
Carnegie,Pa. C12 .....7.65
Chicago W18 .....7.65
Cleveland A7, C20 .....7.65
Detroit B5, P17 .....7.85
Detroit S41 .....7.65
Donora,Pa. A7 .....7.65
Elyria,O. W8 .....7.65
FranklinPark,Ill. N5 ....7.65
Gary,Ind. R2 .....7.65
GreenBay,Wis. F7 ....7.65
Hammond,Ind.J5, L2 ..7.65
Hartford,Conn. R2 ....8.15
Harvey,Ill. B5 .....7.65
LosAngeles(49) S30 ...9.10
LosAngeles(49) P2, R2.9.10
Mansfield,Mass. B2 ...8.20
Massillon,O. R2, R8 ....7.65
Midland,Pa. C18 .....7.65
Monaca,Pa. S17 .....7.65
Newark,N.J. W18 ....8.10
NewCastle,Pa.(17) B4 ..7.65
Pittsburgh J5 .....7.65
Plymouth,Mich. P5 ....7.90
Putman,Conn. W18 ....8.20
Readville,Mass. C14 ...8.20
S.Chicago,Ill. W14 ....7.65
SpringCity,Pa. K3 ....8.10
Struthers,O. Y1 .....7.65
Warren,O. C17 .....7.65
Waukegan,Ill. A7 .....7.65
WillimanticConn. J5 ...8.15
Youngstown F3, Y1 ....7.65

BARS, Cold-Finished Carbon (Turned and Ground)
CumberlandMd. (5) .C19 6.55

BARS, Cold-Finished Alloy
Ambridge,Pa. W18 ...9.025
BeaverFalls,Pa. M12,R2 9.025
Bethlehem,Pa. B2 ....9.025
Bridgeport,Conn. C32 ..9.175
Buffalo B5 .....9.025
Camden,N.J. P13 .....9.20
Canton,O. T7 .....9.025
Carnegie,Pa. C12 ....9.025
Chicago W18 .....9.025
Cleveland A7, C20 ....9.025
Detroit B5, P17 .....9.225
Detroit S41 .....9.025
Donora,Pa. A7 .....9.025
Elyria,O. W8 .....9.025
FranklinPark,Ill. N5 ..9.025
Gary,Ind. R2 .....9.025
GreenBay,Wis. F7 ...9.025
Hammond,Ind. J5, L2..9.025
Hartford,Conn. R2 ....9.325
Harvey,Ill. B5 .....9.025
Lackawanna,N.Y. B2 ..9.025
LosAngeles P2, S30 ...11.00
Mansfield,Mass. B5 ..9.325
Massillon,O. R2, R8 ...9.025
Midland, Pa. C18 ....9.025
Monaca,Pa. S17 .....9.025
Newark,N. J. W18 ....9.20
Plymouth,Mich. P5 ...9.225
S.Chicago,Ill. W14 ....9.025
SpringCity,Pa. K3 ....9.20
Struthers,O. Y1 .....9.025
Warren,O. C17 .....9.025
Waukegan,Ill. A7 .....9.025
Willimantic,Conn. J5 ..9.325
Worcester,Mass. A7 ..9.325
Youngstown F3, Y1 ..9.025

BARS, Reinforcing, Billet (To fabricators)

AlabamaCity,Ala. R2 ..5.675
Atlanta A11 .....5.675
Birmingham C15 .....5.675
Buffalo R2 .....5.675
Cleveland R2 .....5.675
Ecorse,Mich. G5 .....5.675
Emeryville,Calif. J7 ...6.425
Fairfield,Ala. T2 .....5.675
Fairless,Pa. U5 .....5.825
Fontana,Calif. K1 ....6.375
Ft.Worth,Tex.(4)(26)T4 5.925
Gary,Ind. U5 .....5.675
Houston S5 .....5.925
Ind.Harbor,Ind. I-2, Y1 5.675
Johnstown,Pa. B2 .....5.675
Joliet,Ill. P22 .....5.675
KansasCity,Mo. S5 ....5.925
Kokomo,Ind. C16 .....5.775
Lackawanna,N.Y. B2 ..5.675
LosAngeles B3 .....6.375
Madison,Ill. L1 .....5.875
Milton,Pa. M18 .....5.825
Minnequa,Colo. C10 ..6.125
Niles,Calif. P1 .....6.375
Pittsburg,Calif. C11 ..6.375
Pittsburgh J5 .....5.675
Portland,Oreg. O4 .....6.425
SandSprings,Okla. S5 ..5.925
Seattle B3, N14 .....6.425
S.Chicago,Ill. R2, W14.5.675
S.Duquesne,Pa. U5 ....5.675
S.SanFrancisco B3 ....6.425
SparrowsPoint,Md. B2..5.675
Sterling,Ill.(1) N15 ....5.675
Sterling,Ill. N15 .....5.775
Struthers,O. Y1 .....5.675
Tonawanda,N.Y. B12 ...6.10
Torrance,Calif. C11 ...6.375
Youngstown R2, U5 ...5.675

BARS, Reinforcing, Billet (Fabricated; to Consumers)

Baltimore B2 .....7.42
Boston B2, U8 .....8.15
Chicago U8 .....7.41
Cleveland U8 .....7.39
Houston S5 .....7.60
Johnstown,Pa. B2 .....7.33
KansasCity,Mo. S5 .....7.60
Lackawanna,N.Y. B2 ..7.35
Marion,O. P11 .....6.70
Newark,N.J. U8 .....7.80
Philadelphia U8 .....7.63
Pittsburgh J5, U8 .....7.35
SandSprings,Okla. S5 ...7.60
Seattle B3, N14 .....7.95
SparrowsPt.,Md. B2 ...7.33
St. Paul U8 .....8.17
Williamsport,Pa. S19 ...7.25

BARS, Wrought Iron

Economy,Pa.(S.R.)B14 14.90
Economy,Pa.(D.R.)B14 18.55
Economy(Staybolt)B14 19.00

BARS, Rail Steel

ChicagoHts.(3) C2, I-2.5.575
ChicagoHts.(4)(44) I-2.5.675
ChicagoHts.(4) C2 ....5.675
Franklin,Pa.(3) F5 ....5.575
Franklin,Pa.(4) F5 ....5.675
JerseyShore,Pa.(3) J8 ..5.55
Marion,O.(3) P11 ....5.575
Tonawanda(3) B12 ....5.575
Tonawanda(4) B12 ....6.10

SHEETS

SHEETS, Hot-Rolled Steel (18 Gage and Heavier)

Lackawanna,N.Y. B2 ..5.10
Allenport,Pa. P7 .....5.10
Aliquippa,Pa. J5 .....5.10
Ashland,Ky.(8) A10 ....5.10
Cleveland J5, R2 .....5.10
Conshohocken,Pa. A3 ..5.15
Detroit(8) M1 .....5.10
Ecorse,Mich. G5 .....5.10
Fairfield,Ala. T2 .....5.10
Fairless,Pa. U5 .....5.15
Farrell,Pa. S3 .....5.10
Fontana,Calif. K1 ....5.825
Gary,Ind. U5 .....5.10
Geneva,Utah C11 .....5.20
GraniteCity,Ill.(8) G4 ..5.20
Ind.Harbor,Ind. I-2, Y1.5.10
Irvin,Pa. U5 .....5.10
Lackawanna,N.Y. B2 ..5.10
Mansfield,O. E6 .....5.10
Munhall,Pa. U5 .....5.10
Newport,Ky. A2 .....5.10
Niles,O. M21, S3 .....5.10
Pittsburg,Calif. C11 ....5.80
Pittsburgh J5 .....5.10
Portsmouth,O. P12 ....5.10
Riverdale,Ill. A1 .....5.10
Sharon,Pa. S3 .....5.10
S.Chicago,Ill. U5, W14..5.10
SparrowsPoint,Md. B2 ..5.10
Steubenville,O. W10 ....5.10
Warren,O. R2 .....5.10
Weirton,W.Va. W6 ....5.10
Youngstown U5, Y1 ....5.10

SHEETS, H.R. (19 Ga. & Lighter)

Niles,O. M21, S3 .....6.275

SHEETS, H.R. Alloy

Gary,Ind. U5 .....8.40
Ind.Harbor,Ind. Y1 ....8.40
Irvin,Pa. U5 .....8.40
Munhall,Pa. U5 .....8.40
Newport,Ky. A2 .....8.40
Youngstown U5, Y1 ....8.40

SHEETS, H.R. (14 Ga. & Heavier) High-Strength, Low-Alloy

Aliquippa, Pa. J5 ....7.525
Ashland,Ky. A10 .....7.525
Cleveland J5, R2 ....7.525
Conshohocken,Pa. A3 ..7.575
Ecorse,Mich. G5 .....7.525
Fairfield,Ala. T2 .....7.525
Fairless,Pa. U5 .....7.575
Farrell,Pa. S3 .....7.525
Fontana,Calif. K1 .....8.25
Gary,Ind. U5 .....7.525
Ind.Harbor,Ind. I-2, Y1.7.525
Irvin,Pa. U5 .....7.525
Lackawanna(35) B2 ..7.525
Munhall,Pa. U5 .....7.525
Niles,O. S3 .....7.525
Pittsburgh J5 .....7.525
S.Chicago,Ill. U5, W14.7.525
Sharon,Pa. S3 .....7.525
SparrowsPoint(36) B2..7.525
Warren,O. R2 .....7.525
Weirton,W.Va. W6 ....7.525
Youngstown U5, Y1 ..7.525

SHEETS, Hot-Rolled Ingot Iron (18 Gage and Heavier)

Ashland, Ky.(8) A10....5.35
Cleveland R2 .....5.875
Warren,O. R2 .....5.875

SHEETS, Cold-Rolled Ingot Iron

Cleveland R2 .....7.05
Middletown,O. A10 ...6.775
Warren,O. R2 .....7.05

SHEETS, Cold-Rolled Steel (Commercial Quality)

AlabamaCity,Ala. R2 ..6.275
Allenport,Pa. P7 .....6.275
Aliquippa,Pa. J5 .....6.275
Cleveland J5, R2 .....6.275
Conshohocken,Pa. A3 ..6.325
Detroit M1 .....6.275
Ecorse,Mich. G5 .....6.275
Fairfield,Ala. T2 .....6.275
Fairless,Pa. U5 .....6.325
Follansbee,W.Va. F4 ..6.275
Fontana,Calif. K1 .....7.40
Gary,Ind. U5 .....6.275
GraniteCity,Ill. G4 ....6.375
Ind.Harbor,Ind. I-2, Y1.6.275
Irvin,Pa. U5 .....6.275
Lackawanna,N.Y. B2..6.275
Mansfield,O. E6 .....6.275
Middletown,O. A10 ....6.275
Newport,Ky. A2 .....6.275
Pittsburg,Calif. C11 ..7.225
Pittsburgh J5 .....6.275
Portsmouth,O. P12 ....6.275
SparrowsPoint,Md. B2..6.275
Steubenville,O. W10 ..6.275
Warren,O. R2 .....6.275
Weirton,W.Va. W6 ...6.275
Yorkville,O. W10 .....6.275
Youngstown Y1 .....6.275

SHEETS, Cold-Rolled, High-Strength, Low-Alloy

Aliquippa,Pa. J5 .....9.275
Cleveland J5, R2 .....9.275
Ecorse,Mich. G5 .....9.275
Fairless,Pa. U5 .....9.325
Fontana,Calif. K1 .....10.40
Gary,Ind. U5 .....9.275
Ind.Harbor,Ind. I-2, Y1.9.275
Lackawanna(37) B2 ...9.275
Pittsburgh J5 .....9.275
SparrowsPoint(38) B2..9.275
Warren,O. R2 .....9.275
Weirton,W.Va. W6 ....9.275
Youngstown Y1 .....9.275

SHEETS, Culvert	Cu Steel	Cu Fe
Ala.City,Ala. R2	7.225	....
Ashland,Ky. A10	7.225	7.475
Canton,O. R2	7.225	7.75
Fairfield T2	7.225	7.475
Gary,Ind. U5	7.225	7.475
GraniteCity,Ill.G4	7.325	....
Ind.Harbor I-2	7.225	7.475
Irvin,Pa. U5	7.225	7.475
Kokomo,Ind. C16	7.325	....
MartinsFry. W10	7.225	7.475
Pitts.,Calif. C11	7.975	....
SparrowsPt. B2	7.225	....
Pittsburgh J5	7.225	....

SHEETS, Culvert—Pure Iron

Ind.Harbor,Ind. I-2 ....7.475

SHEETS, Galvanized Steel Hot-Dipped

AlabamaCity,Ala. R2 .6.875†
Ashland,Ky. A10 ....6.875†
Canton,O. R2 .....6.875†
Dover,O. E6 .....6.875†
Fairfield,Ala. T2 ....6.875†
Gary,Ind. U5 .....6.875†
GraniteCity,Ill. G4 ....6.975*
Ind.Harbor,Ind. I-2 ..6.875†
Irvin,Pa. U5 .....6.875†
Kokomo,Ind. C16 ....6.975‡
MartinsFerry,O. W10 .6.875*
Middletown,O. A10 ....6.875†
Pittsburg,Calif. C11 ..7.625*
Pittsburgh J5 .....6.875†
SparrowsPt.,Md. B2 ..6.875†
Warren,O. R2 .....6.875†
Weirton,W.Va. W6 ....6.875*

*Continuous and noncontinuous. †Continuous. ‡Noncontinuous.

SHEETS, Well Casing

Fontana,Calif. K1 ....7.325

SHEETS, Galvanized High-Strength, Low-Alloy

Irvin,Pa. U5 .....10.125
SparrowsPt.(39) B2 ..10.025
Pittsburgh J5 .....10.125

SHEETS, Galvannealed Steel

Canton,O. R2 .....7.275
Irvin,Pa. U5 .....7.275

SHEETS, Galvanized Ingot Iron (Hot-Dipped Continuous)

Ashland,Ky. A10 .....7.125
Middletown,O. A10 ....7.125

SHEETS, Electrogalvanized

Cleveland(28) R2 .....7.65
Niles,O.(28) R2 .....7.65
Youngstown J5 .....7.50
Weirton,W.Va. W6 ....7.50

SHEETS, Aluminum Coated

Butler,Pa. A10 (type 2) 9.625
Butler,Pa. A10 (type 2) 9.625

SHEETS, Enameling Iron

Ashland,Ky A10 ....6.775
Cleveland R2 .....6.775
Fairfield,Ala. T2 .....6.775
Gary,Ind. U5 .....6.775
GraniteCity,Ill. G4 ....6.875
Ind.Harbor,Ind. I-2,Y1.6.775
Irvin,Pa. U5 .....6.775
Middletown,O. A10 ....6.775
Niles,O. M21, S3 .....6.775
Youngstown Y1 .....6.775

BLUED STOCK, 29 Gage

Dover,O. E6 .....8.70
Follansbee,W.Va. F4 ...8.70
Ind.Harbor,Ind. I-2 ....8.70
Mansfield,O. E6 .....8.70
Warren,O. R2 .....8.70
Yorkville,O. W10 .....8.70

SHEETS, Long Terne, Steel (Commercial Quality)

BeechBottom,W.Va.W10 7.225
Gary,Ind. U5 .....7.225
Mansfield,O. E6 .....7.225
Middletown,O. A10 ....7.225
Niles,O. M21, S3 .....7.225
Warren,O. R2 .....7.225
Weirton,W.Va. W6 ....7.225

SHEETS, Long Terne, Ingot Iron

Middletown,O. A10 ....7.625

Key To Producers

A1 Acme Steel Co.
A2 Acme-Newport Steel Co.
A3 Alan Wood Steel Co.
A4 Allegheny Ludlum Steel
A5 Alloy Metal Wire Div., H. K. Porter Co. Inc.
A6 American Shim Steel Co.
A7 American Steel & Wire Div., U. S. Steel Corp.
A8 Anchor Drawn Steel Co.
A9 Angell Nail & Chaplet
A10 Armco Steel Corp.
A11 Atlantic Steel Co.

B1 Babcock & Wilcox Co.
B2 Bethlehem Steel Co.
B3 Beth. Pac. Coast Steel
B4 Blair Strip Steel Co.
B5 Bliss & Laughlin Inc.
B8 Braeburn Alloy Steel
B9 Brainard Steel Div., Sharon Steel Corp.
B10 E. & G. Brooke, Wickwire Spencer Steel Div., Colo. Fuel & Iron
B11 Buffalo Bolt Co., Div., Buffalo Eclipse Corp.
B12 Buffalo Steel Corp.
B14 A. M. Byers Co.
B15 J. Bishop & Co.

C1 Calstrip Steel Corp.
C2 Calumet Steel Div., Borg-Warner Corp.
C4 Carpenter Steel Co.
C9 Colonial Steel Co.
C10 Colorado Fuel & Iron
C11 Columbia-Geneva Steel
C12 Columbia Steel & Shaft.
C13 Columbia Tool Steel Co.
C14 Compressed Steel Shaft.
C15 Connors Steel Div., H. K. Porter Co. Inc.
C16 Continental Steel Corp.
C17 Copperweld Steel Co.
C18 Crucible Steel Co.
C19 Cumberland Steel Co.
C20 Cuyahoga Steel & Wire
C22 Claymont Plant, Wickwire Spencer Steel Div., Colo. Fuel & Iron
C23 Charter Wire Inc.
C24 G. O. Carlson Inc.
C32 Carpenter Steel of N.Eng.

D2 Detroit Steel Corp.
D4 Disston Div., H. K. Porter Co. Inc.
D6 Driver-Harris Co.
D7 Dickson Weatherproof Nail Co.
D8 Damascus Tube Co.
D9 Wilbur B. Driver Co.

E1 Eastern Gas&Fuel Assoc.
E2 Eastern Stainless Steel
E4 Electro Metallurgical Co.
E5 Elliott Bros. Steel Co.
E6 Empire-Reeves Steel Corp.
E10 Enamel Prod. & Plating

F2 Firth Sterling Inc.
F3 Fitzsimmons Steel Co.
F4 Follansbee Steel Corp.
F5 Franklin Steel Div., Borg-Warner Corp.
F6 Fretz-Moon Tube Co.
F7 Ft. Howard Steel & Wire
F8 Ft. Wayne Metals Inc.

G4 Granite City Steel Co.
G5 Great Lakes Steel Corp.
G6 Greer Steel Co.
G8 Green River Steel Corp.

H1 Hanna Furnace Corp.
H7 Helical Tube Co.

I-1 Igoe Bros. Inc.
I-2 Inland Steel Co.
I-3 Interlake Iron Corp.
I-4 Ingersoll Steel Div., Borg-Warner Corp.
I-6 Ivins Steel Tube Works
I-7 Indiana Steel & Wire Co.

J1 Jackson Iron & Steel Co.
J3 Jessop Steel Co.
J4 Johnson Steel & Wire Co.
J5 Jones & Laughlin Steel
J6 Joslyn Mfg. & Supply
J7 Judson Steel Corp.
J8 Jersey Shore Steel Co.

K1 Kaiser Steel Corp.
K2 Keokuk Electro-Metals
K3 Keystone Drawn Steel
K4 Keystone Steel & Wire
K7 Kenmore Metals Corp.

L1 Laclede Steel Co.
L2 LaSalle Steel Co.
L3 Latrobe Steel Co.
L6 Lone Star Steel Co.
L7 Lukens Steel Co.
L8 Leschen Wire Rope Div., H. K. Porter Co. Inc.

M1 McLouth Steel Corp.
M4 Mahoning Valley Steel
M6 Mercer Pipe Div., Sawhill Tubular Products
M8 Mid-States Steel & Wire
M12 Moltrup Steel Products
M14 McInnes Steel Co.
M16 Md. Fine & Special. Wire
M17 Metal Forming Corp.
M18 Milton Steel Div., Merritt-Chapman&Scott
M21 Mallory-Sharon Metals Corp.
M22 Mill Strip Products Co.

N1 National-Standard Co.
N2 National Supply Co.
N3 National Tube Div., U. S. Steel Corp.
N5 Nelsen Steel & Wire Co.
N6 New England High Carbon Wire Co.
N8 Newman-Crosby Steel
N14 Northwest. Steel Rolling Mills Inc.
N15 Northwestern S.&W. Co.
N20 Neville Ferro Alloy Co.

O4 Oregon Steel Mills

P1 Pacific States Steel Corp.
P2 Pacific Tube Co.
P4 Phoenix Iron & Steel Co., Sub. of Barium Steel Corp.
P5 Pilgrim Drawn Steel
P6 Pittsburgh Coke & Chem.
P7 Pittsburgh Steel Co.
P11 Pollak Steel Co.
P12 Portsmouth Div., Detroit Steel Corp.
P13 Precision Drawn Steel
P14 Pitts. Screw & Bolt Co.
P15 Pittsburgh Metallurgical
P16 Page Steel & Wire Div., American Chain & Cable
P17 Plymouth Steel Corp.
P19 Pitts. Rolling Mills
P20 Prod. Steel Strip Corp.
P22 Phoenix Mfg. Co.
P24 Phil. Steel & Wire Corp.

R2 Republic Steel Corp.
R3 Rhode Island Steel Corp.
R5 Roebling's Sons, John A.
R6 Rome Strip Steel Co.
R8 Reliance Div., Eaton Mfg.
R9 Rome Mfg. Co.
R10 Rodney Metals Inc.

S1 Seneca Wire & Mfg. Co.
S3 Sharon Steel Corp.
S4 Sharon Tube Co.
S5 Sheffield Div., Armco Steel Corp.
S6 Shenango Furnace Co.
S7 Simmons Co.
S8 Simmons Saw & Steel Co.
S12 Spencer Wire Corp.
S13 Standard Forgings Corp.
S14 Standard Tube Co.
S15 Stanley Works
S17 Superior Drawn Steel Co.
S18 Superior Steel Div., Copperweld Steel Co.
S19 Sweet's Steel Co.
S20 Southern States Steel
S23 Superior Tube Co.
S25 Stainless Welded Prod.
S26 Specialty Wire Co. Inc.
S30 Sierra Drawn Steel Corp.
S40 Seneca Steel Service
S41 Stainless & Strip Div., J&L Steel Corp.
S42 Southern Elec. Steel Co.

T2 Tenn. Coal & Iron Div., U. S. Steel Corp.
T3 Tenn. Products & Chemical Corp.
T4 Texas Steel Co.
T5 Thomas Strip Div., Pittsburgh Steel Co.
T6 Thompson Wire Co.
T7 Timken Roller Bearing
T9 Tonawanda Iron Div., Am.Rad. & Stan. San.
T13 Tube Methods Inc.
T19 Techalloy Co. Inc.

U3 Union Wire Rope Corp.
U4 Universal-Cyclops Steel
U5 United States Steel Corp.
U6 U. S. Pipe & Foundry
U7 Ulbrich Stainless Steels
U8 U. S. Steel Supply Div., U. S. Steel Corp.

V2 Vanadium-Alloys Steel
V3 Vulcan-Kidd Steel Div., H. K. Porter Co.

W1 Wallace Barnes Steel Div., Associated Spring Corp.
W2 Wallingford Steel Corp.
W3 Washburn Wire Co.
W4 Washington Steel Corp.
W6 Weirton Steel Co.
W8 Western Automatic Machine Screw Co.
W9 Wheatland Tube Co.
W10 Wheeling Steel Corp.
W12 Wickwire Spencer Steel Div., Colo. Fuel & Iron
W13 Wilson Steel & Wire Co.
W14 Wisconsin Steel Div., International Harvester
W15 Woodward Iron Co.
W18 Wyckoff Steel Co.

Y1 Youngstown Sheet & Tube

STRIP

STRIP, Hot-Rolled Carbon

Ala.City,Ala.(27) R2	5.10
Allenport,Pa. P7	5.10
Alton,Ill. L1	5.30
Ashland,Ky.(8) A10	5.10
Atlanta A11	5.10
Bessemer,Ala. T2	5.10
Birmingham C15	5.10
Buffalo(27) R2	5.10
Conshohocken,Pa. A3	5.15
Detroit M1	5.10
Ecorse,Mich. G5	5.10
Fairfield,Ala. T2	5.10
Farrell,Pa. S3	5.10
Fontana,Calif. K1	5.825
Gary,Ind. U5	5.10
Ind.Harbor,Ind. I-2, Y1	5.10
Johnstown,Pa.(25) B2	5.10
Lackaw'na,N.Y.(25) B2	5.10
LosAngeles(25) B3	5.85
LosAngeles C1	8.60
Minnequa,Colo. C10	6.20
Riverdale,Ill. A1	5.10
SanFrancisco S7	6.60
Seattle(25) B3	6.10
Seattle N14	6.60
Sharon,Pa. S3	5.10
S.Chicago W14	5.10
S.SanFrancisco(25) B3	5.85
SparrowsPoint,Md. B2	5.10
Torrance,Calif. C11	5.85
Warren,O. R2	5.10
Weirton,W.Va. W6	5.10
Youngstown U5	5.10

STRIP, Hot-Rolled Alloy

Carnegie,Pa. S18	8.40
Farrell,Pa. S3	8.40
Gary,Ind. U5	8.40
Houston S5	8.65
Ind.Harbor,Ind. Y1	8.40
KansasCity,Mo. S5	8.65
LosAngeles B3	9.60
Lowellville,O. S3	8.40
Newport,Ky. A2	8.40
Sharon,Pa. A2, S3	8.40
S.Chicago,Ill. W14	8.40
Youngstown U5, Y1	8.40

STRIP, Hot-Rolled High-Strength, Low-Alloy

Ashland,Ky. A10	7.575
Bessemer,Ala. T2	7.575
Conshohocken,Pa. A3	7.575
Ecorse,Mich. G5	7.575
Fairfield,Ala. T2	7.575
Farrell,Pa. S3	7.575
Gary,Ind. U5	7.575
Ind.Harbor,Ind. I-2,Y1	7.575
Lackawanna,N.Y. B2	7.575
LosAngeles(25) B3	8.325
Seattle(25) B3	8.575
Sharon,Pa. S3	7.575
S.Chicago,Ill. W14	7.575
S.SanFrancisco(25) B3	8.325
SparrowsPoint,Md. B2	7.575
Warren,O. R2	7.575
Weirton,W.Va. W6	7.575
Youngstown U5, Y1	7.575

STRIP, Hot-Rolled Ingot Iron

Ashland,Ky.(8) A10	5.35
Warren,O. R2	5.875

STRIP, Cold-Rolled Carbon

Anderson,Ind. G6	7.425
Baltimore T6	7.425
Boston T6	7.975
Buffalo S40	7.425
Cleveland A7, J5	7.425
Dearborn,Mich. S3	7.425
Detroit D2, M1, P20	7.425
Dover, O. G6	7.425
Evanston,Ill. M22	7.525
Farrell,Pa. S3	7.425
Follansbee,W.Va. F4	7.425
Fontana,Calif. K1	9.20
FranklinPark,Ill T6	7.525
Ind.Harbor,Ind. Y1	7.425
Indianapolis S41	7.575
LosAngeles C1, S41	9.30
McKeesport,Pa. E10	7.525
NewBedford,Mass. R10	7.875
NewBritain,Conn. S15	7.875
NewCastle,Pa. B4, E5	7.425
NewHaven,Conn. D2	7.875
NewKensington,Pa. A6	7.425
Pawtucket,R.I. R3	7.975
Pawtucket,R.I. N8	7.975
Philadelphia P24	7.875
Pittsburgh J5	7.425
Riverdale,Ill. A1	7.525
Rome,N.Y.(32) R6	7.425
Sharon,Pa. S3	7.425
Trenton,N.J.(31) R5	8.875
Wallingford,Conn. W2	7.875
Warren,O. R2, T5	7.425
Worcester,Mass. A7	7.975
Youngstown S41, Y1	7.425

STRIP, Cold-Rolled Alloy

Boston T6	15.90
Carnegie,Pa. S18	15.55
Cleveland A7	15.55
Dover,O. G6	15.55
Farrell,Pa. S3	15.55
FranklinPark,Ill. T6	15.55
Harrison,N.J. C18	15.55
Indianapolis S41	15.70
LosAngeles S41	17.75
Lowellville,O. S3	15.55
Pawtucket,R.I. N8	15.90
Riverdale,Ill. A1	15.55
Sharon,Pa. S3	15.55
Worcester,Mass. A7	15.85
Youngstown S41	15.55

STRIP, Cold-Rolled High-Strength, Low-Alloy

Cleveland A7	10.80
Dearborn,Mich. S3	10.80
Dover,O. G6	10.80
Farrell,Pa. S3	10.80
Ind.Harbor,Ind. Y1	10.80
Sharon,Pa. S3	10.80
Warren,O. R2	10.80

STRIP, Cold-Finished Spring Steel (Annealed)

	0.26-0.40C	0.41-0.60C	0.61-0.80C	0.81-1.05C	1.06-1.35C
Baltimore T6	9.50	10.70	12.90	15.90	18.85
Boston T6	9.50	10.70	12.90	15.90	18.85
Bristol,Conn. W1	...	10.70	12.90	16.10	19.30
Carnegie,Pa. S18	8.95	10.40	12.60	15.60	....
Cleveland A7	8.95	10.40	12.60	15.60	18.55
Dearborn,Mich. S3	9.05	10.50	12.70	....	....
Detroit D2	9.05	10.50	12.70	15.70	....
Dover,O. G6	8.95	10.40	12.60	15.60	18.55
Evanston,Ill. M22	8.95	10.40	12.60	15.60	....
Farrell,Pa. S3	8.95	10.40	12.60	15.60	18.55
Fostoria,O. S1	10.05	10.40	12.60	15.60	....
FranklinPark,Ill. T6	9.05	10.40	12.60	15.60	18.55
Harrison,N.J. C18	...	....	12.90	16.10	19.30
Indianapolis S41	9.10	10.55	12.60	15.60	18.55
LosAngeles C1	11.15	12.60	14.80	17.80	....
LosAngeles S41	11.15	12.60	14.80	....	....
NewBritain,Conn. S15	9.40	10.70	12.90	15.90	18.85
NewCastle,Pa. B4, E5	8.95	10.40	12.60	15.60	....
NewHaven,Conn D2	9.40	10.70	12.90	15.90	....
NewKensington,Pa. A6	8.95	10.40	12.60	15.60	....
New York W3	....	10.70	12.90	16.10	19.30
Pawtucket,R.I. N8	9.50	10.70	12.90	15.90	18.85
Riverdale,Ill. A1	9.05	10.40	12.60	15.60	18.55
Rome,N.Y.(32) R6	8.95	10.40	12.60	15.60	18.55
Sharon,Pa. S3	8.95	10.40	12.60	15.60	18.55
Trenton,N.J. R5	....	10.70	12.90	15.90	18.85
Wallingford,Conn. W2	9.40	10.70	12.90	15.90	18.75
Warren,O. T5	8.95	10.40	12.60	15.60	18.55
Worcester,Mass. A7, T6	9.50	10.70	12.90	15.90	18.85
Youngstown S41	8.95	10.40	12.60	15.60	18.55

Spring Steel (Tempered)

	Up to 0.80C	0.81-1.05C	1.06-1.35C
Bristol, Conn. W1	18.85	22.95	27.80
Buffalo W12	18.85	....	....
Fostoria,O. S1	19.05	22.15	....
FranklinPark,Ill. T6	19.20	23.30	28.15
Harrison,N.J. C18	18.85	22.95	27.80
New York W3	18.85	22.95	27.80
Palmer,Mass. W12	18.85	....	....
Trenton,N.J. R5	18.85	22.95	27.80
Worcester,Mass. A7, T6	18.85	22.95	27.80
Youngstown S41	19.20	23.30	28.15

TIN MILL PRODUCTS

TIN PLATE, Electrolytic (Base Box)	0.25 lb	0.50 lb	0.75 lb
Aliquippa,Pa. J5	$9.10	$9.35	$9.75
Fairfield,Ala. T2	9.20	9.45	9.85
Fairless,Pa. U5	9.20	9.45	9.85
Fontana,Calif. K1	9.75	10.00	10.40
Gary,Ind. U5	9.10	9.35	9.75
GraniteCity,Ill. G4	9.20	9.45	9.60
IndianaHarbor,Ind. I-2, Y1	9.10	9.35	9.75
Irvin,Pa. U5	9.10	9.35	9.75
Niles,O. R2	9.10	9.35	9.75
Pittsburg,Calif. C11	9.75	10.00	10.40
SparrowsPoint,Md. B2	9.10	9.35	9.75
Yorkville,O. W10	9.10	9.35	9.75

ELECTROLYTIC TIN-COATED SHEET (20-27 Ga.; Dollars per 100 lb)

Aliquippa,Pa. J5	7.90	8.10	...
Niles,O. R2	7.90	8.10	8.30

TIN PLATE, American

	1.25 lb	1.50 lb
Aliquippa,Pa.J5	$10.40	$10.65
Fairfield,Ala. T2	10.50	10.75
Fairless,Pa. U5	10.50	10.75
Fontana,Calif.K1	11.05	11.30
Gary,Ind. U5	10.40	10.65
Ind.Harb. Y1	10.40	10.65
Pitts.,Calif. C11	11.05	11.30
Sp.Pt.,Md. B2	10.40	10.65
Weirton,W.Va.W6	10.40	10.65
Yorkville,O. W10	10.40	10.65

BLACK PLATE (Base Box)

Aliquippa,Pa. J5	$8.20
Fairfield,Ala. T2	8.30
Fairless,Pa. U5	8.30
Fontana,Calif. K1	8.85
Gary,Ind. U5	8.20
GraniteCity,Ill. G4	8.30
Ind.Harbor,Ind. I-2, Y1	8.20
Irvin,Pa. U5	8.20
Niles,O. R2	8.20
Pittsburg,Calif. C11	8.85
SparrowsPoint,Md. B2	8.25
Weirton,W.Va. W6	8.20
Yorkville,O. W10	8.20

HOLLOWARE ENAMELING Black Plate (29 Gage)

Aliquippa,Pa. J5	7.85
Gary,Ind. U5	7.85
GraniteCity,Ill. G4	7.95
Ind.Harbor,Ind. Y1	7.85
Irvin,Pa. U5	7.85
Yorkville,O. W10	7.85

MANUFACTURING TERNES (Special Coated, Base Box)

Gary,Ind. U5	$9.70
Irvin,Pa. U5	9.70

ROOFING SHORT TERNES (8 lb Coated, Base Box)

Gary,Ind. U5	$11.25

STRIP, Galvanized (Continuous)

Farrell,Pa. S3	7.50
Sharon,Pa. S3	7.50

TIGHT COOPERAGE HOOP

Atlanta A11	5.65
Farrell,Pa. S3	5.525
Riverdale,Ill. A1	5.675
Sharon,Pa. S3	5.525
Youngstown U5	5.525

STRIP, Cold-Rolled Ingot Iron

Warren,O. R2	8.175

STRIP, C.R. Electrogalvanized

Cleveland A7	7.425*
Dover,O. G6	7.425*
Evanston,Ill. M22	7.525*
McKeesport,Pa. E10	7.50*
Riverdale,Ill. A1	7.525*
Warren,O. B9, S3, T5	7.425*
Worcester,Mass. A7	7.975
Youngstown S41	7.425*

*Plus galvanizing extras.

SILICON STEEL

C.R. COILS & CUT LENGTHS (22 Ga.)

Fully Processed (Semiprocessed ½c lower)	Field	Armature	Electric	Motor	Dynamo
BeechBottom,W.Va. W10	....	11.70	12.40	13.55	14.65
Brackenridge,Pa. A4	....	....	12.40	13.55	14.65
GraniteCity,Ill. G4	9.975*	11.30*	12.00*	13.15*	....
IndianaHarbor,Ind. I-2	9.875*	11.20*	11.90*	13.05*	....
Mansfield,O. E6	9.875*	11.70	12.40	13.55	14.65
Newport,Ky. A2	9.875	11.70*	12.40*	13.55*	14.65*
Niles,O. M21	9.875*	11.70	12.40	13.55	....
Vandergrift,Pa. U5	9.875*	11.70	12.40	13.55	14.65
Warren,O. R2	9.875*	11.70	12.40	13.55	14.65
Zanesville,O. A10	....	11.70†	12.40	13.55	14.65

	Stator
Vandergrift,Pa. U5	8.10
Mansfield,O. E6	8.10

SHEETS (22 Ga., coils & cut lengths)

Fully Processed (Semiprocessed ½c lower)	T-72	T-65	T-58	T-52
BeechBottom,W.Va. W10	15.70	16.30	16.80	17.85
Vandergrift,Pa. U5	15.70	16.30	16.80	17.85
Zanesville,O. A10	15.70	16.30	16.80	17.85

C.R. COILS & CUT LENGTHS (22 Ga.) — Grain Oriented

	T-100	T-90	T-80	T-73	T-66	T-72
Brackenridge,Pa. A4	....	18.10	19.70	20.20	20.70	15.70††
Butler,Pa. A10	....	....	19.70	20.20	20.70	....
Vandergrift,Pa. U5	17.10	18.10	19.70	20.20	20.70	15.70
Warren,O. R2	....	....	....	....	....	15.70‡

*Semiprocessed. †Fully processed only. ‡Coils, annealed, semiprocessed½c lower. ††Coils only.

WIRE

WIRE, Manufacturers Bright, Low Carbon

AlabamaCity,Ala. R2	8.00
Aliquippa,Pa. J5	8.00
Alton,Ill. L1	8.20
Atlanta A1	8.00
Bartonville,Ill. K4	8.10
Buffalo W12	8.00
Chicago W13	8.00
Cleveland A7, C20	8.00
Crawfordsville,Ind. M8	8.10
Donora,Pa. A7	8.00
Duluth A7	8.00
Fairfield,Ala. T2	8.00
Fostoria,O.(24) S1	8.10
Houston S5	8.25
Jacksonville,Fla. M8	8.35
Johnstown,Pa. B2	8.00
Joliet,Ill. A7	8.00
KansasCity,Mo. S5	8.25
Kokomo,Ind. C16	8.10
LosAngeles B3	8.95
Minnequa,Colo. C10	8.25
Monessen,Pa. P7, P16	8.00
N.Tonawanda,N.Y. B11	8.00
Palmer,Mass. W12	8.30
Pittsburg,Calif. C11	8.95
Portsmouth,O. P12	8.00
Rankin,Pa. A7	8.00
S.Chicago,Ill. R2	8.00
S.SanFrancisco C10	8.95
SparrowsPoint, Md. B2	8.10
Sterling,Ill.(1) N15	8.00
Sterling,Ill. N15	8.10
Struthers,O. Y1	8.00
Waukegan,Ill. A7	8.00
Worcester,Mass. A7	8.30

WIRE, Cold Heading Carbon

Elyria,O. W8	8.00

WIRE, Gal'd., for ACSR

Bartonville,Ill. K4	12.65
Buffalo W12	13.40
Cleveland A7	12.65
Donora,Pa. A7	12.65
Duluth A7	12.65
Johnstown,Pa. B2	13.40
Minnequa,Colo. C10	12.775
Monessen,Pa. P7, P16	12.65
Muncie,Ind. I-7	13.60
NewHaven,Conn. A7	12.95
Palmer,Mass. W12	13.70
Pittsburg,Calif. C11	13.45
Portsmouth,O. P12	12.65
Roebling,N.J. R5	12.95
SparrowsPt.,Md. B2	13.50
Struthers,O. Y1	13.40
Trenton,N.J. A7	12.95
Waukegan,Ill. A7	12.65
Worcester,Mass. A7	12.95

WIRE, Upholstery Spring

Aliquippa,Pa. J5	9.75
Alton,Ill. L1	9.95
Buffalo W12	9.75
Cleveland A7	9.75
Donora,Pa. A7	9.75
Duluth A7	9.75
Johnstown,Pa. B2	9.75
KansasCity,Mo. S5	10.00
LosAngeles B3	10.70
Minnequa,Colo. C10	9.95
Monessen,Pa. P7, P16	9.75
NewHaven,Conn. A7	10.05
Palmer,Mass. W2	10.05
Pittsburg,Calif. C11	10.70
Portsmouth,O. P12	9.75
Roebling,N.J. R5	10.05
S.Chicago,Ill. R2	9.75
S.SanFrancisco C10	10.70
SparrowsPt.,Md. B2	9.85
Struthers,O. Y1	9.75
Trenton,N.J. A7	10.05
Waukegan,Ill. A7	9.75
Worcester,Mass. A7	10.05

WIRE, MB Spring, High-Carbon

Aliquippa,Pa. J5	9.75
Alton,Ill. L1	9.95
Bartonville,Ill. K4	9.85
Buffalo W12	9.75
Cleveland A7	9.75
Donora,Pa. A7	9.75
Duluth A7	9.75
Fostoria,O. S1	9.80
Johnstown,Pa. B2	9.75
KansasCity,Mo. S5	10.00
LosAngeles B3	10.70
Milbury,Mass.(12) N6	10.05
Minnequa,Colo. C10	9.95
Monessen,Pa. P7, P16	9.75
Muncie,Ind. I-7	9.95
Palmer,Mass. W12	10.05
Pittsburg,Calif. C11	10.70
Portsmouth,O. P12	9.75
Roebling,N.J. R5	10.05
S.Chicago,Ill. R2	9.75
S.SanFrancisco C10	10.70
SparrowsPt., Md. B2	9.85
Struthers,O. Y1	9.75
Trenton,N.J. A7	10.05
Waukegan,Ill. A7	9.75
Wor'ster,Mass.A7,J4,T6	10.05

WIRE, Fine & Weaving(8" Coils)

Alton,Ill. L1	16.50
Bartonville,Ill. K4	16.40
Chicago W13	16.30
Cleveland A7	16.30
Crawfordsville,Ind. M8	16.40
Fostoria,O. S1	16.30
Houston S5	16.55
Jacksonville,Fla. M8	16.65
Johnstown,Pa. B2	16.30
KansasCity,Mo. S5	16.55
Kokomo,Ind. C16	16.30
Minnequa,Colo. C10	16.55
Monessen,Pa. P16	16.30
Muncie,Ind. I-7	16.50
Palmer,Mass. W12	16.60
S.SanFrancisco C10	17.15
Waukegan,Ill. A7	16.30
Worcester,Mass. A7, J6	16.60

WIRE, Tire Bead

Bartonville,Ill. K4	17.15
Monessen,Pa. P16	17.15
Roebling,N.J. R5	17.65

ROPE WIRE (A)

Bartonville,Ill. K4	13.45
Buffalo W12	13.45
Fostoria,O. S1	13.45
Johnstown,Pa. B2	13.45
Monessen,Pa. P7	13.45
Muncie,Ind. I-7	13.65
Palmer,Mass. W12	13.75
Portsmouth,O. P12	13.45
Roebling,N.J. R5	13.75
St.Louis L8	13.45
SparrowsPt.,Md. B2	13.55
Struthers,O. Y1	13.45
Worcester,Mass. J4	13.75

(A) Plow and Mild Plow; add 0.25c for Improved Plow

WIRE, Cold-Rolled Flat

Anderson,Ind. G6	12.35
Baltimore T6	12.65
Boston T6	12.65
Buffalo W12	12.35
Chicago W13	12.45
Cleveland A7	12.35
Crawfordsville,Ind. M8	12.35
Dover,O. G6	12.35
Farrell,Pa. S3	11.65
Fostoria,O. S1	12.35
FranklinPark,Ill. T6	12.45
Kokomo,Ind. C16	12.35
Massillon,O. R8	12.35
Milwaukee C23	12.55
Monessen,Pa. P7, P16	12.35
Palmer,Mass. W12	12.65
Pawtucket,R.I. N8	11.95
Philadelphia P24	12.65
Riverdale,Ill. A1	12.45
Rome,N.Y. R6	12.35
Sharon,Pa. S3	12.35
Trenton,N.J. R5	12.65
Warren,O. B9	12.35
Worcester,Mass. A7,T6	12.65

NAILS, Stock — Col.

AlabamaCity,Ala. R2	173
Aliquippa,Pa. J5	173
Atlanta A11	175
Bartonville,Ill. K4	175
Chicago W13	173
Cleveland A9	173
Crawfordsville,Ind. M8	175
Donora,Pa. A7	173
Duluth A7	173
Fairfield,Ala. T2	173
Houston S5	178
Jacksonville,Fla. M8	175
Johnstown,Pa. B2	173
Joliet,Ill. A7	173
KansasCity,Mo. S5	178
Kokomo,Ind. C16	175
Minnequa,Colo. C10	178
Monessen,Pa. P7	173
Pittsburg,Calif. C11	192
Rankin,Pa. A7	173
S.Chicago,Ill. R2	173
SparrowsPt.,Md. B2	175
Sterling,Ill. (7) N15	175
Worcester,Mass. A7	179

(To Wholesalers; per cwt)

Galveston,Tex. D7	$10.30

NAILS, Cut (100 lb keg)
To Dealers (33)

Wheeling,W.Va. W10	$9.80

POLISHED STAPLES — Col.

AlabamaCity,Ala. R2	175
Aliquippa,Pa. J5	173
Atlanta A11	177
Bartonville,Ill. K4	177
Crawfordsville,Ind. M8	177
Donora,Pa. A7	173
Duluth A7	173
Fairfield,Ala. T2	173
Houston S5	180
Jacksonville,Fla. M8	177
Johnstown,Pa. B2	175
Joliet,Ill. A7	173
KansasCity,Mo. S5	180
Kokomo,Ind. C16	177
Minnequa,Colo. C10	180
Pittsburg,Calif. C11	194
Rankin,Pa. A7	173
S.Chicago,Ill. R2	175
SparrowsPt.,Md. B2	177
Sterling,Ill. (7) N15	175
Worcester,Mass. A7	181

TIE WIRE, Automatic Baler
(14½ Ga.) (per 97 lb Net Box)
Coil No. 3150

AlabamaCity,Ala. R2	$10.26
Atlanta A11	10.36
Bartonville,Ill. K4	10.36
Buffalo W12	10.26
Chicago W13	10.26
Crawfordsville,Ind. M8	10.36
Donora,Pa. A7	10.26
Duluth A7	10.26
Fairfield,Ala. T2	10.26
Houston S5	10.51
Jacksonville,Fla. M8	10.36
Johnstown,Pa. B2	10.26
Joliet,Ill. A7	10.26
KansasCity,Mo. S5	10.51
Kokomo,Ind. C16	10.36
LosAngeles B3	11.05
Minnequa,Colo. C10	10.51
Pittsburg,Calif. C11	11.04
S.Chicago,Ill. R2	10.26
S.SanFrancisco C10	11.04
SparrowsPt.,Md. B2	10.36
Sterling,Ill. (37) N15	10.36

Coil No. 6500 Stand.

AlabamaCity,Ala. R2	$10.60
Atlanta A11	10.70
Bartonville,Ill. K4	10.70
Buffalo W12	10.60
Chicago W13	10.60
Crawfordsville,Ind. M8	10.70
Donora,Pa. A7	10.60
Duluth A7	10.60
Fairfield,Ala. T2	10.60
Houston S5	10.85
Jacksonville,Fla. M8	10.70
Johnstown,Pa. B2	10.60
Joliet,Ill. A7	10.60
KansasCity,Mo. S5	10.85
Kokomo,Ind. C16	10.70
LosAngeles B3	11.40
Minnequa,Colo. C10	10.85
Pittsburg,Calif. C11	11.40
S.Chicago,Ill. R2	10.60
S.SanFrancisco C10	11.40
SparrowsPt.,Md. B2	10.70
Sterling,Ill. (37) N15	10.70

Coil No. 6500 Interim

AlabamaCity,Ala. R2	$10.65
Atlanta A11	10.75
Bartonville,Ill. K4	10.75
Buffalo W12	10.65
Chicago W13	10.65
Crawfordsville,Ind. M8	10.75
Donora,Pa. A7	10.65
Duluth A7	10.65
Fairfield,Ala. T2	10.65
Houston S5	10.90
Jacksonville,Fla. M8	10.75
Johnstown,Pa. B2	10.65
Joliet,Ill. A7	10.65
KansasCity,Mo. S5	10.90
Kokomo,Ind. C16	10.75
LosAngeles B3	11.45
Minnequa,Colo. C10	10.90
Pittsburg,Calif. C11	11.45
S.Chicago,Ill. R2	10.65
S.SanFrancisco C10	11.45
SparrowsPt.,Md. B2	10.75
Sterling,Ill. (37) N15	10.75

BALE TIES, Single Loop — Col.

AlabamaCity,Ala. R2	212
Atlanta A11	214
Bartonville,Ill. K4	214
Crawfordsville,Ind. M8	214
Donora,Pa. A7	212
Duluth A7	212
Fairfield,Ala. T2	212
Houston S5	217
Jacksonville,Fla. M8	214
Joliet,Ill. A7	212
KansasCity,Mo. S5	217
Kokomo,Ind. C16	214
Minnequa,Colo. C10	217
Pittsburg,Calif. C11	236
S.SanFrancisco C10	236
SparrowsPt.,Md. B2	214
Sterling,Ill. (7) N15	214

FENCE POSTS

Birmingham C15	177
ChicagoHts.,Ill. C2, I-2	177
Duluth A7	177
Franklin,Pa. F5	177
Johnstown,Pa. B2	177
Marion,O. P11	177
Minnequa,Colo. C10	182
Sterling,Ill. (1) N15	177
Tonawanda,N.Y. B12	177

WIRE, Barbed — Col.

AlabamaCity,Ala. R2	193**
Aliquippa,Pa. J5	190§
Atlanta A11	198§
Bartonville,Ill. K4	198
Crawfordsville,Ind. M8	198
Donora,Pa. A7	193†
Duluth A7	193†
Fairfield,Ala. T2	193†
Houston S5	198**
Jacksonville,Fla. M8	198
Johnstown,Pa. B2	196§
Joliet,Ill. A7	193†
KansasCity,Mo. S5	198**
Kokomo,Ind. C16	195†
Minnequa,Colo. C10	198**
Monessen,Pa. P7	196§
Pittsburg,Calif. C11	213†
Rankin,Pa. A7	193†
S.Chicago,Ill. R2	193**
S.SanFrancisco C10	213*
SparrowsPoint,Md. B2	198§
Sterling,Ill. (7) N15	198††

WOVEN FENCE, 9-15 Ga. — Col.

Ala.City,Ala. R2	187**
Aliq'ppa,Pa. 9-11½ga. J5	190§
Atlanta A11	192§
Bartonville,Ill. K4	192
Crawfordsville,Ind. M8	192
Donora,Pa. A7	187†
Duluth A7	187†
Fairfield,Ala. T2	187†
Houston S5	192**
Jacksonville,Fla. M8	192
Johnstown,Pa. (43) B2	190§
Joliet,Ill. A7	187†
KansasCity,Mo. S5	192**
Kokomo,Ind. C16	189†
Minnequa,Colo. C10	192**
Pittsburg,Calif. C11	210†
Rankin,Pa. A7	187†
S.Chicago,Ill. R2	187**
Sterling,Ill. (7) N15	192††

WIRE (16 gage) — An'ld Stone — Galv. Stone

Ala.City,Ala. R2	17.85	19.40**
Aliq'ppa,Pa. J5	17.85	19.65
Bartonville K4	17.95	19.75
Cleveland A7	17.85	....
Craw'dsville M8	17.95	19.80‡‡
Fostoria,O. S1	18.35	19.90†
Houston S5	18.10	19.65**
Jacksonville M8	17.95	19.80‡‡
Johnstown B2	17.85	19.65§
Kan.City,Mo. S5	18.10	....
Kokomo C16	17.25	18.80†
Minnequa C10	18.10	19.65**
P'lm'r,Mass. W12	18.15	19.70†
Pitts.,Calif. C11	18.20	19.75†
S.SanFran. C10	18.20	19.75**
Sterling(37) N15	17.25	19.05††
SparrowsPt. B2	17.95	19.75§
Waukegan A7	17.85	19.40†
Worcester A7	18.15	....

WIRE, Merchant Quality
(6 to 8 gage) — An'ld — Galv.

Ala.City,Ala. R2	9.00	9.55**
Aliquippa J5	8.65	9.325§
Atlanta(48) A11	9.10	9.775§
Bartonville(48) K4	9.10	9.775
Buffalo W12	9.00	9.55†
Cleveland A7	9.00	....
Crawfordsville M8	9.10	9.80‡‡
Donora,Pa. A7	9.00	9.55†
Duluth A7	9.00	9.55†
Fairfield T2	9.00	9.55†
Houston(48) S5	9.25	9.80**
Jack'ville,Fla. M8	9.10	9.80‡‡
Johnstown B2(48)	9.00	9.675§
Joliet,Ill. A7	9.00	9.55†
Kans.City(48) S5	9.25	9.80**
Kokomo(48) C16	9.10	9.65†
LosAngeles B3	9.95	10.625§
Monessen (48) P7	8.65	9.35§
Palmer,Mass. W12	9.30	9.85†
Pitts.,Calif. C11	9.95	10.50†
Rankin,Pa. A7	9.00	9.55†
S.Chicago R2	9.00	9.55**
S.SanFran. C10	9.95	10.50**
Spar'wsPt.(48) B2	9.10	9.775§
Sterling(48) N15	9.25	9.925††
St'ling(1)(48) N15	9.15	9.825††
Struthers,O. Y1	9.00	9.65‡
Worcester,Mass. A7	9.30	9.85†

Based on zinc price of: *13.50. †5c. §10c. ‡Less than 10c. ††10.50c. ‡‡11.00c. **Subject to zinc equalization extras.

FASTENERS

(Base discounts, shipments of one to four containers, per cent off list, f.o.b. mill)

BOLTS

Machine Bolts

Full Size Body (cut thread)
½ in. and smaller

3 in. and shorter	55.0
3¼ in. thru 6 in.	50.0
Longer than 6 in.	37.0
⅝ in., 3 in. & shorter	47.0
3¼ in. thru 6 in.	40.0
Longer than 6 in.	31.0
¾ in. thru 1 in.:	
6 in. and shorter	37.0
Longer than 6 in.	31.0
1⅛ in. and larger:	
All lengths	31.0

Undersize Body (rolled thread)
½ in. and smaller:

3 in. and shorter	55.0
3¼ in. thru 6 in.	50.0

Carriage Bolts

Full Size Body (cut thread) & Undersize Body (rolled thread)
½ in. and smaller:

6 in. and shorter	48.0
Larger diameters and longer lengths	35.0

Lag, Plow, Tap, Blank, Step, Elevator, Tire, and Fitting Up Bolts
½ in. and smaller:

6 in. and shorter	48.0
Larger diameters and longer lengths	35.0

High Tensile Structural Bolts
(Reg. semifinished hex head bolts, heavy semifinished hex nuts. Bolts — High-carbon steel, heat treated, Spec. ASTM A-325, in bulk. Full keg quantity)

⅝ in. diam.	50.0
¾ in. diam.	47.0
⅞ and 1 in. diam.	43.0
1⅛ and 1¼ in. diam.	34.0

NUTS
(Keg or case quantity and over)

Square Nuts, Reg. & Heavy:

All sizes	56.0

(Full container)

Hex Nuts, Reg. & Heavy Hot Pressed & Cold Punched:

¾ in. and smaller	62.0
⅞ in. to 1½ in., incl.	56.0
1⅝ in. and larger	51.5

Hex Nuts, Semifinished, Heavy (Incl. Slotted):

¾ in. and smaller	62.0
⅞ in. to 1½ in., incl.	56.0
1⅝ in. and larger	51.5

STEEL ANN 5pt CLEM 12-8

Hex Nuts, Finished (Incl. Slotted and Castellated):

⅞ in. and smaller	65.0
1 in. to 1½ in., incl.	57.0
1⅝ in. and larger	51.5

Semifinished Hex Nuts, Reg. (Incl. Slotted):

⅝ in. and smaller	62.0
¾ in. to ⅞ in., incl.	65.0
1 in. to 1½ in., incl.	57.0
1⅝ in. and larger	51.5

CAP AND SETSCREWS
(Base discounts, packages, per cent off list, f.o.b. mill)

Hex Head Cap Screws, Coarse or Fine Thread, Bright:
6 in. and shorter:

⅝ in. and smaller	35.0
¾, ⅞, and 1 in.	16.0
Longer than 6 in.:	
⅝ in. and smaller	3.0
¾, ⅞, and 1 in.	+11.0

High Carbon, Heat Treated:
6 in. and shorter:

⅝ in. and smaller	20.0
¾, ⅞, and 1 in.	+ 5.0
Longer than 6 in.:	
⅝ in. and smaller	+19.0
¾, ⅞, and 1 in.	+39.0

Flat Head Cap Screws:
¾ in. and smaller, 6 in. and shorter +85.0

Setscrews, Square Head,

Cup Point, Coarse Thread:
Through 1 in. diam.:
6 in. and shorter + 5.0
Longer than 6 in. +29.0

RIVETS

F.o.b. Cleveland and/or freight equalized with Pittsburgh, f.o.b. Chicago and/or freight equalized with Birmingham except where equalization is too great.
Structural ½ in., larger 12.85
⅞ in. and smaller by 6 in. and shorter: 15.0%.

PRESTRESSED STRAND

(High strength, stress relieved; 7 wire uncoated. Net prices per 1000 ft, 40,000 lb and over)

	Standard Diameter, Inches 1/4	5/16	3/8	7/16	1/2
Alton,Ill. L1	$32.15	$48.20	$61.55	$81.10	$105.65
Buffalo W12	28.95	43.40	55.40	73.00	95.10
Cleveland A7	28.95	43.40	55.40	73.00	....
KansasCity,Mo. U3	32.15	48.20	61.55	81.10	105.65
Monessen,Pa. P16	32.15	48.20	61.55	81.10	105.65
NewHaven,Conn. A7	28.95	43.40	55.40	73.00	95.10
Pittsburg,Calif. C11	....	43.40	55.40	73.00	....
Pueblo,Colo. W12	28.95	43.40	55.40	73.00	95.10
Roebling,N.J. R5	28.95	43.40	55.40	73.00	95.10
St.Louis L8	28.95	43.40	55.40	73.00	95.10
Waukegan,Ill. A7	28.95	43.40	55.40	73.00	95.10

RAILWAY MATERIALS

	Standard No. 1	Standard No. 2	All No. 2	Tee Rails 60 lb Under
Bessemer,Pa. U5	5.75	5.65	....	6.725
Ensley,Ala. T2	5.75	5.65	....	6.725
Fairfield,Ala. T2	....	....	....	6.725
Gary,Ind. U5	5.75	5.65	....	....
Huntington,W.Va. C15	....	....	....	6.50
Johnstown,Pa. B2	....	....	....	(16)6.725
Lackawanna,N.Y. B2	5.75	5.65	....	6.725
Minnequa,Colo. C10	5.75	5.65	....	7.22
Steelton,Pa. B2	5.75	5.65	....	....
Williamsport,Pa. S19	....	....	....	6.725

TIE PLATES

Fairfield,Ala. T2	6.875
Gary,Ind. U5	6.875
Lackawanna,N.Y. B2	6.875
Minnequa,Colo. C10	7.025
Seattle B3	7.025
Steelton,Pa. B2	6.875
Torrance,Calif. C11	6.875

JOINT BARS

Bessemer,Pa. U5	7.25
Fairfield,Ala. T2	7.25
Joliet,Ill. U5	7.25
Lackawanna,N.Y. B2	7.25
Minnequa,Colo. C10	7.25
Steelton,Pa. B2	7.25

AXLES

Ind.Harbor,Ind. S13	9.125
Johnstown,Pa. B2	9.125

TRACK BOLTS, Untreated

Cleveland R2	15.35
KansasCity,Mo. S5	15.35
Lebanon,Pa. B2	15.35
Minnequa,Colo. C10	15.35
Pittsburgh P14	14.75
Seattle B3	15.85

SCREW SPIKES

Lebanon,Pa. B2	15.10

STANDARD TRACK SPIKES

Fairfield,Ala. T2	9.75
Ind.Harbor,Ind. I-2,Y1	10.10
KansasCity,Mo. S5	10.10
Lebanon,Pa. B2	10.10
Minnequa,Colo. C10	10.10
Pittsburgh J5	10.10
Seattle B3	10.60
S.Chicago,Ill. R2	10.10
Struthers,O. Y1	10.10
Youngstown R2	10.10

Footnotes

(1) Chicago base.
(2) Angles, flats, bands.
(3) Merchant.
(4) Reinforcing.
(5) 1⅛ to under 1 7/16 in.; 1 7/16 to under 1 15/16 in., 6.70c; 1 15/16 to 8 in., inclusive, 7.05c.
(6) Chicago or Birm. base.
(7) Chicago base 2 cols. lower.
(8) 16 Ga. and heavier.
(9) Merchant quality; add 0.35c for special quality.
(10) Pittsburgh base.
(11) Cleveland & Pitts. base.
(12) Worcester, Mass., base.
(13) Add 0.25c for 17 Ga. & heavier.
(14) Gage 0.143 to 0.249 in.; for gage 0.142 and lighter, 5.80c.
(15) ⅜" and thinner.
(16) 40 lb and under.
(17) Flats only; 0.25 in. & heavier.
(18) To dealers.
(19) Chicago & Pitts. base.
(21) New Haven, Conn., base.
(22) Deld. San Francisco Bay area.
(23) Special quality.
(24) Deduct 0.05c, finer than 15 Ga.
(25) Bar mill bands.
(26) Deld. in mill zone, 6.295c.
(27) Bar mill sizes.
(28) Bonderized.
(29) Youngstown base.
(30) Sheared; for universal mill add 0.45c.
(31) Widths over ⅝ in.; 7.375c, for width ⅝ in. and under by 0.125 in. and thinner.
(32) Buffalo base.
(33) To jobbers, deduct 20c.
(34) 9.60c for cut lengths.
(35) 72" and narrower.
(36) 54" and narrower.
(37) Chicago base, 10 points lower.
(38) 14 Ga. & lighter; 48" & narrower.
(39) 48" and narrower.
(40) Lighter than 0.035"; 0.035" and heavier, 0.25c higher.
(41) 9.10c for cut lengths.
(42) Mill lengths, f.o.b. mill; deld. in mill zone or within switching limits, 5.635c.
(43) 9-14½ Ga.
(44) To fabricators.
(48) 6-7 Ga.
(49) 3½ in. and smaller rounds; 9.65c, over 3½ in. and other shapes.

SEAMLESS STANDARD PIPE, Threaded and Coupled

Carload discounts from list, %

Size—Inches	2		2½		3		3½		4		5		6	
List Per Ft	37c		58.5c		76.5c		92c		$1.09		$1.48		$1.92	
Pounds Per Ft	3.68		5.82		7.62		9.20		10.89		14.81		19.18	
	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*
Aliquippa, Pa. J5	+12.25	+28.75	+5.75	+23.5	+3.25	+21	+1.75	+19.5	+1.75	+19.5	+2	+19.75	0.5	+17.25
Ambridge, Pa. N2	+12.25	....	+5.75	....	+3.25	....	+1.75	....	+1.75	....	+2	....	0.5	....
Lorain, O. N3	+12.25	+28.75	+5.75	+23.5	+3.25	+21	+1.75	+19.5	+1.75	+19.5	+2	+19.75	0.5	+17.25
Youngstown Y1	+12.25	+28.75	+5.75	+23.5	+3.25	+21	+1.75	+19.5	+1.75	+19.5	+2	+19.75	0.5	+17.25

ELECTRICWELD STANDARD PIPE, Threaded and Coupled

Carload discounts from list, %

Youngstown R2	+12.25	+28.75	+5.75	+23.5	+3.25	+21	+1.75	+19.5	+1.75	+19.5	+2	+19.75	0.5	+17.25

BUTTWELD STANDARD PIPE, Threaded and Coupled

Carload discounts from list, %

Size—Inches	⅛		¼		⅜		½		¾		1		1¼	
List Per Ft	5.5c		6c		6c		8.5c		11.5c		17c		23c	
Pounds Per Ft	0.24		0.42		0.57		0.85		1.13		1.68		2.28	
	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*
Aliquippa, Pa. J5	....	....	....	....	....	....	2.25	+15	5.25	+11	8.75	+6.5	11.25	+5.25
Alton, Ill. L1	....	....	....	....	....	....	0.25	+17	3.25	+13	6.75	+8.5	9.25	+7.25
Benwood, W. Va. W10	1.5	+27	+10.5	+36	+21	+45.5	2.25	+15	5.25	+11	8.75	+6.5	11.25	+5.25
Butler, Pa. F6	4.5	+24	+8.5	+34	+19.5	+44	....	....	....	....	....	....	....	....
Etna, Pa. N2	....	....	....	....	....	....	2.25	+15	5.25	+11	8.75	+6.5	11.25	+5.25
Fairless, Pa. N3	....	....	....	....	....	....	0.25	+17	3.25	+13	6.75	+8.5	9.25	+7.25
Fontana, Calif. K1	....	....	....	....	....	....	+10.75	+28	+7.75	+24	+4.25	+19.5	+1.75	+18.25
Indiana Harbor, Ind. Y1	....	....	....	....	....	....	1.25	+16	4.25	+12	7.75	+7.5	10.25	+7.75
Lorain, O. N3	....	....	....	....	....	....	2.25	+15	5.25	+11	8.75	+6.5	11.25	+5.25
Sharon, Pa. S4	4.5	+24	+8.5	+34	+19.5	+44	....	....	....	....	....	....	....	....
Sharon, Pa. M6	....	....	....	....	....	....	2.25	+15	5.25	+11	8.75	+6.5	11.25	+5.25
Sparrows Pt., Md. B2	0.5	+28	+11.5	+37	+22	+45.5	0.25	+17	3.25	+13	6.75	+8.5	9.25	+7.25
Wheatland, Pa. W9	4.5	+24	+8.5	+34	+19.5	+44	2.25	+15	5.25	+11	8.75	+6.5	11.25	+5.25
Youngstown R2, Y1	....	....	....	....	....	....	2.25	+15	5.25	+11	8.75	+6.5	11.25	+5.25

Size—Inches	1½		2		2½		3		3½		4	
List Per Ft	27.5c		37c		58.5c		76.5c		92c		$1.09	
Pounds Per Ft	2.72		3.68		5.82		7.62		9.20		10.89	
	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*	Blk	Galv*
Aliquippa, Pa. J5	11.75	+4.25	12.25	+3.75	13.75	+3.5	13.75	+3.5	....	....	....	....
Alton, Ill. L1	9.75	+6.25	10.25	+5.75	11.75	+5.5	11.75	+5.5	1.25	+16.5	1.25	+16.5
Benwood, W. Va. W10	11.75	+4.25	12.25	+3.75	13.75	+3.5	13.75	+3.5	3.25	+14.5	3.25	+14.5
Etna, Pa. N2	11.75	+4.25	12.25	+3.75	13.75	+3.5	13.75	+3.5	3.25	+14.5	3.25	+14.5
Fairless, Pa. N3	9.75	+6.25	10.25	+5.75	11.75	+5.5	11.75	+5.5	1.25	+16.5	1.25	+16.5
Fontana, Calif. K1	+1.25	+17.25	+0.75	+16.75	0.75	+16.5	0.75	+16.5	+9.75	+27.5	+9.75	+27.5
Indiana Harbor, Ind. Y1	10.75	+5.25	11.25	+4.75	12.75	+4.5	12.25	+4.5	2.25	+15.5	2.25	+15.5
Lorain, O. N3	11.75	+4.25	12.25	+3.75	13.75	+3.5	13.75	+3.5	....	....	....	....
Sharon, Pa. M6	11.75	+4.25	12.25	+3.75	13.75	+3.5	13.75	+3.5	....	....	....	....
Sparrows Pt., Md. B2	9.75	+6.25	10.25	+5.75	11.75	+5.5	11.75	+5.5	1.25	+16.5	1.25	+16.5
Wheatland, Pa. W9	11.75	+4.25	12.25	+3.75	13.75	+3.5	13.75	+3.5	3.25	+14.5	3.25	+14.5
Youngstown R2, Y1	11.75	+4.25	12.25	+3.75	13.75	+3.5	13.75	+3.5	3.25	+14.5	3.25	+14.5

*Galvanized pipe discounts based on current price of zinc (11.50c, East St. Louis).

Stainless Steel

Representative prices, cents per pound; subject to current lists of extras

AISI Type	—Rerolling— Ingot	Slabs	Forging Billets	H.R. Strip	H.R. Rods; C.F. Wire	Bars; Structural Shapes	Plates	Sheets	C.R. Strip; Flat Wire
201	22.00	27.00	....	36.00	40.00	42.00	39.25	48.50	45.00
202	23.75	30.25	36.50	39.00	40.75	43.00	40.00	49.25	49.25
301	23.25	28.00	37.25	37.25	42.00	44.25	41.25	51.25	47.50
302	25.25	31.50	38.00	40.50	42.75	45.00	42.25	52.00	52.00
302B	25.50	32.75	40.75	45.75	45.00	47.25	44.50	57.00	57.00
303	....	32.00	41.00	46.00	45.50	48.00	45.00	56.75	56.75
304	27.00	33.25	40.50	44.25	45.25	47.75	45.75	55.00	55.00
304L	....	....	48.25	51.50	53.00	55.50	53.50	63.25	63.25
305	28.50	36.75	42.50	47.50	45.25	47.75	46.25	58.75	58.75
308	30.75	38.25	47.25	50.25	52.75	55.75	55.25	63.00	63.00
309	39.75	49.50	57.75	64.50	63.75	67.00	66.00	80.50	80.50
310	49.75	61.50	78.00	84.25	86.50	91.00	87.75	96.75	96.75
314	....	....	77.50	....	86.50	91.00	87.75	99.00	104.25
316	39.75	49.50	62.25	69.25	69.25	73.00	71.75	80.75	80.75
316L	....	55.50	70.00	76.50	77.00	80.75	79.50	89.25	89.25
317	48.00	60.00	76.75	88.25	86.25	90.75	88.50	101.00	101.00
321	32.25	40.00	47.00	53.50	52.50	55.50	54.75	65.50	65.50
330	....	....	118.75	....	132.00	138.50	135.50	149.25	149.25
18-8 CbTa	37.00	46.50	55.75	63.50	61.50	64.75	64.75	79.25	79.25
403	....	....	28.25	....	32.00	33.75	30.00	40.25	40.25
405	19.50	25.50	29.75	36.00	33.50	35.25	32.50	46.75	46.75
410	16.75	21.50	28.25	31.00	32.00	33.75	30.00	40.25	40.25
416	....	....	28.75	....	32.50	34.25	31.25	48.25	48.25
420	26.00	33.50	34.25	41.75	39.25	41.25	40.25	62.00	62.00
430	17.00	21.75	28.75	32.00	32.50	34.25	31.00	40.75	40.75
430F	....	....	29.50	....	33.00	34.75	31.75	51.75	51.75
431	....	28.75	37.75	....	42.00	44.25	41.00	56.00	56.00
446	....	....	39.25	59.00	44.25	46.50	42.75	70.00	70.00

Stainless Steel Producers Are: Allegheny Ludlum Steel Corp.; American Steel & Wire Div., U. S. Steel Corp.; Anchor Drawn Steel Co., division of Vanadium-Alloys Steel Co.; Armco Steel Corp.; Babcock & Wilcox Co.; Bethlehem Steel Co.; J. Bishop & Co.; A. M. Byers Co.; G. O. Carlson Inc.; Carpenter Steel Co.; Carpenter Steel Co. of New England; Charter Wire Products; Crucible Steel Co. of America; Damascus Tube Co.; Dearborn Div., Sharon Steel Corp.; Wilbur B. Driver Co.; Driver-Harris Co.; Eastern Stainless Steel Corp.; Firth Sterling Inc.; Fort Wayne Metals Inc.; Green River Steel Corp., subsidiary of Jessop Steel Co.; Indiana Steel & Wire Co.; Ingersoll Steel Div., Borg-Warner Corp.; Ellwood Ivins Steel Tube Works Inc.; Jessop Steel Co.; Johnson Steel & Wire Co. Inc.; Stainless & Strip Div., Jones & Laughlin Steel Corp.; Joslyn Stainless Steels, division of Joslyn Mfg. & Supply Co.; Latrobe Steel Co.; Lukens Steel Co.; Maryland Fine & Specialty Wire Co. Inc.; McLouth Steel Corp.; Metal Forming Corp.; Midvale-Heppenstall Co.; National Standard Co.; National Tube Div., U. S. Steel Corp.; Pacific Tube Co.; Page Steel & Wire Div., American Chain & Cable Co. Inc.; Pittsburgh Rolling Mills Inc.; Republic Steel Corp.; Riverside-Alloy Metal Div., H. K. Porter Company Inc.; Rodney Metals Inc.; Sawhill Tubular Products Inc.; Sharon Steel Corp.; Simonds Saw & Steel Co.; Specialty Wire Co. Inc.; Standard Tube Co.; Superior Steel Div., Copperweld Steel Co.; Superior Tube Co.; Swepco Tube Corp.; Techalloy Co. Inc.; Timken Roller Bearing Co.; Trent Tube Co., subsidiary of Crucible Steel Co. of America; Tube Methods Inc.; Ulbrich Stainless Steel Inc.; U. S. Steel Corp.; Universal Cyclops Steel Corp.; Vanadium-Alloys Steel Co.; Wall Tube & Metal Products Co.; Wallingford Steel Co., subsidiary of Allegheny Ludlum Steel Corp., Washington Steel Corp.

Clad Steel

	Plates 5%	Plates Carbon Base 10%	Plates Carbon Base 15%	Plates Carbon Base 20%	Sheets Carbon Base 20%
Stainless					
302	....	....	....	....	37.50
304	26.05	28.80	31.55	34.30	39.75
304L	30.50	33.75	36.95	40.15	....
316	38.20	42.20	46.25	50.25	58.25
316L	42.30	46.75	51.20	55.65	....
316 Cb	49.90	55.15	60.40	65.65	....
321	31.20	34.50	37.75	41.05	47.25
347	36.90	40.80	44.65	48.55	57.00
405	22.25	24.60	26.90	29.25	....
410	20 55	22.70	24.85	27.00	....
430	21.20	23.45	25.65	27.90	....
Inconel	48.90	59.55	70.15	80.85	....
Nickel	41.65	51.95	63.30	72.70	....
Nickel, Low Carbon	41.95	52.60	63.30	74.15	....
Monel	43.35	53.55	63.80	74.05	....

	Strip, Carbon Base —Cold Rolled— 10%	Both Sides
Copper*	34.75	40.65

*Deoxidized. Production points: Stainless-clad sheets, New Castle, Ind. I-4; stainless-clad plates, Claymont, Del. C22, Coatesville, Pa. L7, New Castle, Ind. I-4, and Washington, Pa. J3, nickel, inconel, monel-clad plates, Coatesville L7; copper-clad strip, Carnegie, Pa. S18.

Tool Steel

Grade	$ per lb	Grade	$ per lb
Reg. Carbon (W-1)	0.330	W-Cr Hot Work (H-12)	0.530
Spec. Carbon (W-1)	0.385	V-Cr Hot Work (H-13)	0.550
Oil Hardening (O-1)	0.505	W Hot Wk. (H-21)	1.425-1.44
V-Cr Hot Work (H-11)	0.505	Hi-Carbon-Cr (D-11)	0.955

Grade by Analysis (%) W	Cr	V	Co	Mo	AISI Designation	$ per lb
18	4	1	....	...	T-1	1.840
18	4	2	....	...	T-2	2.005
13.5	4	3	....	...	T-3	2.105
18.25	4.25	1	4.75	...	T-4	2.545
18	4	2	9	...	T-5	2.915
20.25	4.25	1.6	12.95	...	T-6	4.330
13.75	3.75	2	5	...	T-8	2.485
1.5	4	1	....	8.5	M-1	1.200
6.4	4.5	1.9	....	5	M-2	1.345
6	4	3	....	6	M-3	1.590

Tool steel producers include: A4, A8, B2, B8, C4, C9, C12, C18, F2, J3, L3, M14, S8, U4, V2, and V3.

Pig Iron

F.o.b. furnace prices in dollars per gross ton, as reported to STEEL. Minimum delivered prices are approximate.

	Basic	No. 2 Foundry	Malle-able	Besse-mer
Birmingham District				
Birmingham R2	62.00	62.50**	....	....
Birmingham U6	....	62.50**	66.50	....
Woodward,Ala. W15	62.50*	62.50**	66.50	....
Cincinnati, deld.	....	70.20	..	....
Buffalo District				
Buffalo H1, R2	66.00	66.50	67.00	67.50
N. Tonawanda,N.Y. T9	....	66.50	67.00	67.50
Tonawanda,N.Y. W12	66.00	66.50	67.00	67.50
Boston, deld.	77.29	77.79	78.29	....
Rochester,N.Y., deld.	69.02	69.52	70.02	....
Syracuse,N.Y., deld.	70.12	70.62	71.12	....
Chicago District				
Chicago I-3	66.00	66.50	66.50	67.00
S.Chicago,Ill. R2	66.00	66.50	66.50	67.00
S.Chicago,Ill. W14	66.00	....	66.50	67.00
Milwaukee, deld.	69.02	69.52	69.52	70.02
Muskegon,Mich., deld.	....	74.52	74.52	....
Cleveland District				
Cleveland R2, A7	66.00	66.50	66.50	67.00
Akron,Ohio, deld.	69.52	70.02	70.02	70.52
Mid-Atlantic District				
Birdsboro,Pa. B10	68.00	68.50	69.00	69.50
Chester,Pa. P4	68.00	68.50	69.00	....
Swedeland,Pa. A3	68.00	68.50	69.00	69.50
NewYork, deld.	....	75.50	76.00	....
Newark,N.J., deld.	72.69	73.19	73.69	74.19
Philadelphia, deld.	70.41	70.91	71.41	71.99
Troy,N.Y. R2	68.00	68.50	69.00	69.50
Pittsburgh District				
NevilleIsland,Pa. P6	66.00	66.50	66.50	67.00
Pittsburgh (N&S sides), Aliquippa, deld.	....	67.95	67.95	68.48
McKeesRocks,Pa., deld.	....	67.60	67.60	68.13
Lawrenceville,Homestead, Wilmerding,Monaca,Pa., deld.	....	68.26	68.26	68.79
Verona,Trafford,Pa., deld.	68.29	68.82	68.82	69.35
Brackenridge,Pa., deld.	68.60	69.10	69.10	69.63
Midland,Pa. C18	66.00	....	....	....
Youngstown District				
Hubbard,Ohio Y1	....	....	66.50	....
Sharpsville,Pa. S6	66.00	....	66.50	67.00
Youngstown Y1	....	....	66.50	....
Mansfield,Ohio, deld.	71.30	....	71.80	72.30
Duluth I-3	66.00	66.50	66.50	67.00
Erie,Pa. I-3	66.00	66.50	66.50	67.00
Everett,Mass. E1	67.50	68.00	68.50	....
Fontana,Calif. K1	75.00	75.50	....	....
Geneva,Utah C11	66.00	66.50	....	....
GraniteCity,Ill. G4	67.90	68.40	68.90	....
Ironton,Utah C11	66.00	66.50	....	....
Minnequa,Colo. C10	68.00	68.50	69.00	....
Rockwood,Tenn. T3	....	62.50‡	66.50	....
Toledo,Ohio I-3	66.00	66.50	66.50	67.00
Cincinnati, deld.	72.94	73.44	....	....

*Phos. 0.70-0.90%; Phos. 0.30-0.69%, $63.
**Phos. 0.70-0.90%; Phos. 0.30-0.69%, $63.50.
‡Phos. 0.50% up; Phos. 0.30-0.49, $63.50.

PIG IRON DIFFERENTIALS

Silicon: Add 75 cents per ton for each 0.25% Si or percentage thereof over base grade, 1.75-2.25%, except on low phos. iron on which base is 1.75-2.00%.

Manganese: Add 50 cents per ton for each 0.25% manganese over 1% or portion thereof.

BLAST FURNACE SILVERY PIG IRON, Gross Ton

(Base 6.00-6.50% silicon; add $1 for each 0.50% silicon or portion thereof over the base grade within a range of 6.50 to 11.50%; starting with silicon over 11.50% and $1.50 per ton for each 0.50% silicon or portion thereof up to 14%; add $1 for each 0.50% Mn over 1%)

Jackson,Ohio I-3, J1	$78.00
Buffalo H1	79.25

ELECTRIC FURNACE SILVERY IRON, Gross Ton

(Base 14.01-14.50% silicon; add $1 for each 0.5% Si to 18%; $1.25 for each 0.50% Mn over 1%; $2 per gross ton premium for 0.045% max P)

CalvertCity,Ky. P15	$99.00
NiagaraFalls,N.Y. P15	99.00
Keokuk,Iowa Open-hearth & Fdry, $9 freight allowed K2	103.50
Keokuk,Iowa O.H. & Fdry, 12½ lb piglets, 16% Si, max fr'gt allowed up to $9, K2	106.50

LOW PHOSPHORUS PIG IRON, Gross Ton

Lyles,Tenn. T3 (Phos. 0.035% max)	$73.00
Rockwood,Tenn. T3 (Phos. 0.035% max)	73.00
Troy,N.Y. R2 (Phos. 0.035% max)	73.00
Philadelphia, deld.	81.67
Cleveland A7 (Intermediate) (Phos. 0.036-0.075% max)	71.00
Duluth I-3 (Intermediate) (Phos. 0.036-0.075% max)	71.00
Erie,Pa. I-3 (Intermediate) (Phos. 0.036-0.075% max)	71.00
NevilleIsland,Pa. P6 (Intermediate) (Phos. 0.036-0.075% max)	71.00

Steel Service Center Products

Representative prices, per pound, subject to extras, f.o.b. warehouse. City delivery charges are 15 cents per 100 lb except: Denver, Moline, Norfolk, Richmond, Washington, 20 cents; Baltimore, Boston, Los Angeles, New York, Philadelphia, Portland, Spokane, San Francisco, 10 cents; Atlanta, Birmingham, Chattanooga, Houston, Seattle, no charge.

	SHEETS				STRIP	BARS			Standard Structural Shapes	PLATES	
	Hot-Rolled	Cold-Rolled	Galv. 10 Ga.†	Stainless Type 302	Hot-Rolled*	H.R. Rounds	C.F. Rds.‡	H.R. Alloy 4140††[5]		Carbon	Floor
Atlanta	8.59§	9.86§	10.13	....	8.91	9.39	13.24#	....	9.40	9.29	11.21
Baltimore	8.55	9.25	9.99	....	9.05	9.45	11.85#	15.48	9.55	9.00	10.50
Birmingham	8.18	9.45	10.46	....	8.51	8.99	....	....	9.00	8.89	10.99
Boston	9.31	10.40	11.39	53.50	9.73	10.11	13.39#	15.71	10.01	10.02	11.85
Buffalo	8.40	9.60	10.85	55.98	8.75	9.15	11.45#	15.40	9.25	9.20	10.75
Chattanooga	8.35	9.69	9.65	....	8.40	8.77	10.46	....	8.88	8.80	10.66
Chicago	8.25	9.45	10.50	53.00	8.51	8.99	9.15	15.05	9.00	8.89	10.20
Cincinnati	8.43	9.51	10.55	53.43	8.83	9.31	11.53#	15.37	9.56	9.27	10.53
Cleveland	8.36	9.54	10.65	52.33	8.63	9.10	11.25#	15.16	9.39	9.13	10.44
Dallas	8.80	9.30	....	....	8.85	8.80	....	....	8.75	9.15	10.40
Denver	9.40	11.84	12.94	....	9.43	9.80	11.19	....	9.84	9.76	11.08
Detroit	8.51	9.71	10.87	56.50	8.88	9.30	9.51	15.33	9.56	9.26	10.46
Erie, Pa.	8.20	9.45	9.95[10]	....	8.60	9.10	11.25	....	9.35	9.10	10.60
Houston	8.40	8.90	10.29	52.00	8.45	8.40	11.60	15.75	8.35	8.75	10.10
Jackson, Miss.	8.52	9.79	....	....	8.84	9.82	10.68	....	9.33	9.22	11.03
Los Angeles	8.70[2]	10.80[2]	12.15[2]	57.60	9.15	9.10[2]	12.95[2]	16.35	9.00[2]	9.10[2]	11.30[2]
Memphis, Tenn.	8.59	9.80	....	....	8.84	9.32	11.25#	....	9.33	9.22	10.86
Milwaukee	8.39	9.59	10.64	....	8.65	9.13	9.39	15.19	9.22	9.03	10.34
Moline, Ill.	8.55	9.80	....	....	8.84	8.95	9.15	....	8.99	8.91	....
New York	8.87	10.13	11.10	53.08	9.64	9.99	13.25#	15.50	9.74	9.77	11.05
Norfolk, Va.	8.40	....	....	....	9.10	9.10	12.00	....	9.40	8.85	10.35
Philadelphia	8.20	9.25	11.34	52.71	9.25	9.40	11.95#	15.48	9.10	9.15	10.40**
Pittsburgh	8.35	9.55	10.90	52.00	8.61	8.99	11.25#	15.05	9.00	8.89	10.20
Richmond, Va.	8.40	....	10.40	....	9.10	9.00	....	....	9.40	8.85	10.35
St. Louis	8.63	9.83	10.88	....	8.89	9.37	9.78	15.43	9.48	9.27	10.58
St. Paul	8.79	10.04	11.09	....	8.84	9.21	9.86	....	9.38	9.30	10.49
San Francisco	9.65	11.10	11.00	55.10	9.75	10.15	13.00	16.00	9.85	10.00	12.35
Seattle	10.30	11.55	12.50	58.52	10.25	10.50	14.70	16.80[3]	10.20	10.10	12.50
South'ton, Conn.	9.07	10.33	10.71	....	9.48	9.74	....	....	9.57	9.57	10.91
Spokane	10.35	11.55	12.55	57.38	10.80	11.05	14.70	16.80	10.25	10.15	13.05
Washington	9.15	....	....	....	9.65	10.05	12.50	....	10.15	9.60	11.10

*Prices do not include gage extras; †prices include gage and coating extras; ‡includes 35-cent bar quality extras; §42 in. and under; **⅛ in. and heavier; ††as annealed; ‡‡¾ in. to 4 in. wide, inclusive; #net price, 1 in. round C-1018.

Base quantities, 2000 to 4999 lb except as noted; cold-finished bars, 2000 lb and over except in Seattle, 2000 to 3999 lb; stainless sheets, 8000 lb except in Chicago, New York, Boston, Seattle, 10,000 lb and in San Francisco, 2000 to 4999 lb; hot-rolled products on West Coast, 2000 to 9999 lb, except in Seattle, 30,000 lb and over; [2]—30,000 lb; [3]—1000 to 4999 lb; [5]—1000 to 1999 lb; [10]—2000 lb and over.

Refractories

Fire Clay Brick (per 1000)

High-Heat Duty: Ashland, Grahn, Hayward, Hitchens, Haldeman, Olive Hill, Ky., Athens, Troup, Tex., Beech Creek, Clearfield, Curwensville, Lock Haven, Lumber, Orviston, West Decatur, Winburne, Snow Shoe, Pa., Bessemer, Ala., Farber, Mexico, St. Louis, Vandalia, Mo., Ironton, Oak Hill, Parrall, Portsmouth, Ohio, Ottawa, Ill., Stevens Pottery, Ga., $140; Salina, Pa., $145; Niles, Ohio, $138; Cutler, Utah, $165.

Super-Duty: Ironton, Ohio, Vandalia, Mo., Olive Hill, Ky., Clearfield, Salina, Winburne, Snow Shoe, Pa., New Savage, Md., St. Louis, $185; Stevens Pottery, Ga., $195; Cutler, Utah, $233.

Silica Brick (per 1000)

Standard: Alexandria, Claysburg, Mt. Union, Sproul, Pa., Ensley, Ala., Pt. Matilda, Pa., Portsmouth, Ohio, Hawstone, Pa., $158; Warren, Niles, Windham, Ohio, Hays, Latrobe, Morrisville, Pa., $163; E. Chicago, Ind., Joliet, Rockdale, Ill., $168; Lehigh, Utah, $175; Los Angeles, $180.

Super-Duty: Sproul, Hawstone, Pa., Niles, Warren, Windham, Ohio, Leslie, Md., Athens, Tex., $157; Morrisville, Hays, Latrobe, Pa., $168; E. Chicago, Ind., $167; Curtner, Calif., $182.

Semisilica Brick (per 1000)

Clearfield, Pa., $140; Philadelphia, $145; Woodbridge, N. J., $135.

Ladle Brick (per 1000)

Dry Pressed: Alsey, Ill., Chester, New Cumberland, W. Va., Freeport, Johnstown, Merrill Station, Vanport, Pa., Mexico, Vandalia, Mo., Wellsville, Irondale, New Salisbury, Ohio, $96.75; Clearfield, Pa., Portsmouth, Ohio, $102.

High-Alumina Brick (per 1000)

50 *Per Cent:* St. Louis, Mexico, Vandalia, Mo., $235; Danville, Ill., $253; Philadelphia, $265; Clearfield, Pa., $230; Orviston, Snow Shoe, Pa., $260.

60 *Per Cent:* St. Louis, Mexico, Vandalia, Mo., $295; Danville, Ill., $313; Clearfield, Orviston, Snow Shoe, Pa., $320; Philadelphia, $325.

70 *Per Cent:* St. Louis, Mexico, Vandalia, Mo., $335; Danville, Ill., $353; Clearfield, Orviston, Snow Shoe, Pa., $360; Philadelphia, $365.

Sleeves (per 1000)

Reesdale, Johnstown, Bridgeburg, Pa., St. Louis, $188.

Nozzles (per 1000)

Reesdale, Johnstown, Bridgeburg, Pa., St. Louis, $310.

Runners (per 1000)

Reesdale, Johnstown, Bridgeburg, Pa., $234.

Dolomite (per net ton)

Domestic, dead-burned, bulk, Billmeyer, Blue Bell, Williams, Plymouth Meeting, York, Pa., Millville, W. Va., Bettsville, Millersville, Martin, Woodville, Gibsonburg, Narlo, Ohio, $16.75; Thornton, McCook, Ill., $17; Dolly Siding, Bonne Terre, Mo., $15.60.

Magnesite (per net ton)

Domestic, dead-burned, ½ in. grains with fines: Chewelah, Wash., Luning, Nev., $46; ⅜ in. grains with fines: Baltimore, $73.

Fluorspar

Metallurgical grades, f.o.b. shipping point in Ill., Ky., net tons, carloads, effective CaF_2 content 72.5%, $37-$41; 70%, $36-$40; 60%, $33-$36.50. Imported, net ton, f.o.b. cars point of entry, duty paid, metallurgical grade: European, $30-$33, contract; Mexican, all rail, duty paid, $25; barge, Brownsville, Tex., $27.

Ores

Lake Superior Iron Ore

(Prices effective for the 1958 shipping season, gross ton, 51.50% iron natural, rail of vessel, lower lake ports.)

Mesabi bessemer	$11.60
Mesabi nonbessemer	11.45
Old Range bessemer	11.85
Old Range nonbessemer	11.70
Open-hearth lump	12.70
High phos	11.45

The foregoing prices are based on upper lake rail freight rates, lake vessel freight rates, handling and unloading charges, and taxes thereon, which were in effect Jan. 30, 1957, and increases or decreases after that date are absorbed by the seller.

Eastern Local Iron Ore

Cents per unit, deld. E. Pa.

New Jersey, foundry and basic 62-64% concentrates	18.00-19.00

Metal Powder

(Per pound f.o.b. shipping point in ton lots for minus 100 mesh, except as noted)

	Cents
Sponge Iron, Swedish: deld. east of Mississippi River, ocean bags 23,000 lb and over	11.25
F.o.b. Riverton or Camden, N. J., west of Mississippi River.	9.50
Sponge Iron, Domestic, 98% Fe: Deld. east of Mississippi River, 23,00 lb and over	11.25
100 mesh	9.10
40 mesh	8.10
Electrolytic Iron, Melting stock, 99.87% Fe, irregular fragments of ⅛ in. x 1.3 in.	28.75
(In contract lots of 240 tons price is 22.75c)	
Annealed, 99.5% Fe..	36.50
Unannealed (99 + % Fe)	36.00
Unannealed (99 + % Fe) (minus 325 mesh)	59.00
Powder Flakes (minus 16, plus 100 mesh)..	29.00
Carbonyl Iron: 98.1-99.9%, 3 to 20 microns, depending on grade, 93.00-290.00 in standard 200-lb containers; all minus 200 mesh	
Aluminum: Atomized, 500-lb drum, freight allowed Carlots	38.50
Ton lots	40.50
Antimony, 500-lb lots	42.00*
Brass, 5000-lb lots	33.00-48.90†
Bronze, 5000-lb lots	49.60-53.70†
Copper: Electrolytic	14.25*
Reduced	14.25*
Lead	7.50*
Manganese: Minus 35 mesh	64.00
Minus 100 mesh	70.00
Minus 200 mesh	75.00
Nickel, unannealed	74.00
Nickel-Silver, 5000-lb lots	50.99-55.40†
Phosphor-Copper, 5000-lb lots	61.80
Copper (atomized) 5000-lb lots	42.30-50.80†
Silicon	47.50
Solder	7.00*
Stainless Steel, 304	$1.07
Stainless Steel, 316	$1.26
Tin	14.00*
Zinc, 5000-lb lots	19.00-32.20‡
Tungsten:	Dollars
Melting grade, 99%	
60 to 200 mesh, nominal:	
1000 lb and over	3.15
Less than 1000 lb	3.30
Chromium, electrolytic 99.8% Cr, min metallic basis	5.00

*Plus cost of metal. †Depending on composition. ‡Depending on mesh.

Electrodes

Threaded with nipple; unboxed, f.o.b. plant

GRAPHITE

Inches Diam	Inches Length	Per 100 lb
2	24	$64.00
2½	30	41.50
3	40	39.25
4	40	37.00
5⅛	40	36.50
6	60	33.25
7	60	29.75
8, 9, 10	60	29.50
12	72	28.25
14	60	28.25
16	72	27.25
17	60	27.25
18	72	27.00
20	72	26.50
24	84	27.25

CARBON

8	60	14.25
10	60	13.80
12	60	14.75
14	60	14.75
14	72	12.55
17	60	12.65
17	72	12.10
20	90	11.55
24	72, 84	11.95
24	96	12.10
30	84	12.00
35, 40	110	11.60
40	100	12.50

Imported Steel

(Base per 100 lb, landed, duty paid, based on current ocean rates. Any increase in these rates is for buyer's account. Source of shipment: Western continental European countries.)

	North Atlantic	South Atlantic	Gulf Coast	West Coast
Deformed Bars, Intermediate, ASTM-A 305	$5.10	$5.10	$5.00	$5.45
Bar Size Angles	5.00	5.00	4.90	5.33
Structural Angles	5.00	5.00	4.90	5.33
I-Beams	5.06	5.06	4.96	5.40
Channels	5.06	5.06	4.96	5.40
Plates (basic bessemer)	6.62	6.62	6.62	6.94
Sheets, H.R.	8.20	8.20	8.20	8.50
Sheets, C.R. (drawing quality)	8.75	8.75	8.75	9.12
Furring Channels, C.R., 1000 ft, ¾ x 0.30 lb per ft	25.71	25.59	25.59	26.46
Barbed Wire (†)	6.60	6.60	6.60	6.95
Merchant Bars	5.40	5.40	5.35	5.90
Hot-Rolled Bands	7.15	7.15	7.15	7.55
Wire Rods, Thomas Commercial No. 5	5.15	5.28	5.10	5.45
Wire Rods, O.H. Cold Heading Quality No. 5	6.05	6.18	6.00	6.30
Bright Common Wire Nails (§)	7.89	7.75	7.67	8.26

†Per 82 lb net reel. §Per 100-lb kegs, 20d nails and heavier.

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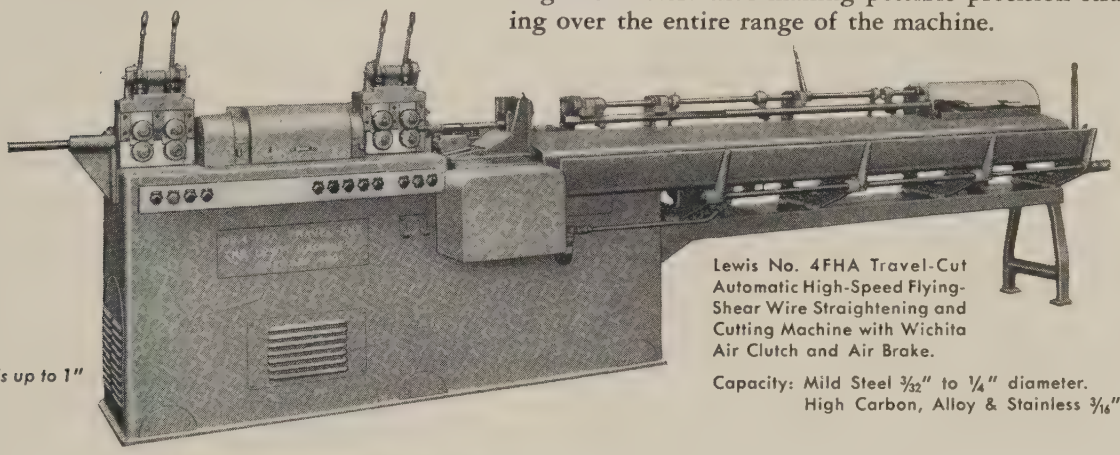
This is the most outstanding development in the field . . . the new Lewis No. 4FHA Wire Straightening and Cutting Machine designed to straighten and cut wire in any lengths at speeds up to 500 FPM.

Through the use of a compound sliding-gear transmission 24 gear combinations permit 20 feed speeds — 75 through 520 FPM with 6 flywheel speeds of 95 through 305 RPM. Another outstanding feature is the Dual-Center Straightener Arbor (Pat. Pending) permitting the use of close centers for small diameters and long centers for the larger diameters thus making possible precision straightening over the entire range of the machine.



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Capacity: Mild Steel 3/32" to 1/4" diameter. High Carbon, Alloy & Stainless 3/16" Maximum.

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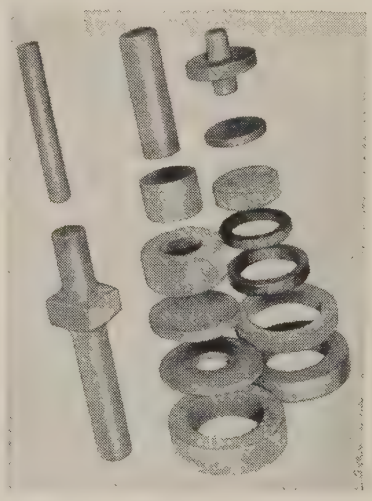

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Ferroalloys

MANGANESE ALLOYS

Spiegeleisen: Carlot, per gross ton, Palmerton, Neville Island, Pa. 21-23% Mn, $105; 19-21% Mn, 1-3% Si, $102.50; 16-19% Mn $100.50.

Standard Ferromanganese: (Mn 74-76%, C 7% approx) base price per net ton, $245, Johnstown, Duquesne, Sheridan, Neville Island, Pa.; Alloy, W. Va.; Ashtabula, Marietta, O.; Sheffield, Ala.; Portland, Oreg. Add or subtract $2 for each 1% or fraction thereof of contained manganese over 76% or under 74%, respectively. (Mn 79-81%). Lump $253 per net ton f.o.b. Anaconda or Great Falls, Mont. Add $2.60 for each 1% above 81%; subtract $2.60 for each 1% below 79%, fractions in proportion to nearest 0.1%.

High-Grade Low-Carbon Ferromanganese: (Mn 85-95%). Carload, lump, bulk, max 0.07% C, 35.1c per lb of contained Mn, carload packed 36.4c, ton lots 37.9c, less ton 39.1c. Delivered. Deduct 1.5c for max 0.15% C grade from above prices, 3c for max 0.03% C, 3.5c for max 0.5% C, and 6.5c for max 75% C—max 7% Si. **Special Grade:** (Mn 90% min, C 0.07% max, P 0.06% max). Add 2.05c to the above prices. Spot, add 0.25c.

Medium-Carbon Ferromanganese: (Mn 80-85%, C 1.25-1.5%, Si 1.5% max). Carload, lump, bulk, 25.5c per lb of contained Mn, packed, carload 26.8c, ton lot 28.4c, less ton 29.6c. Delivered. Spot, add 0.25c.

Manganese Metal: 2" x D (Mn 95.5% min, Fe 2% max, Si 1% max, C 0.2%). Carload, lump, bulk, 45c per lb of metal; packed, 45.75c; ton lot 47.25c; less ton lot 49.25c. Delivered. Spot, add 2c.

Electrolytic Manganese Metal: Mn carload, bulk, 33.25c; 2000 lb to min carload, 36c; less ton, 38c; 50 lb cans, add 0.5c per lb. Premium for hydrogen-removed metal, 0.75c per lb. Prices are f.o.b. cars, Knoxville, Tenn., freight allowed to St. Louis or any point east of Mississippi River; or f.o.b. Marietta, O., freight allowed.

Silicomanganese: (Mn 65-68%). Carload, lump, bulk 1.50% C grade, 18-20% Si, 12.8c per lb of alloy. Packed, c.l. 14c, ton 14.45c, less ton 15.45c, f.o.b. Alloy, W. Va.; Ashtabula, Marietta, O.; Sheffield, Ala.; Portland, Oreg. For 2% grade, Si 15-17%, deduct 0.2c from above prices. For 3% grade, Si 12-14.5%, deduct 0.4c from above prices. Spot, add 0.25c.

TITANIUM ALLOYS

Ferrotitanium, Low-Carbon: (Ti 20-25%, Al 3.5% max, Si 4% max, C 0.10% max). Contract, ton lot, 2" x D, $1.50 per lb of contained Ti; less ton to 300 lb, $1.55. (Ti 38-43%, Al 8% max, Si 4% max, C 0.10% max). Ton lot $1.35, less ton to 300 lb $1.37, f.o.b. Niagara Falls, N. Y., freight allowed to St. Louis.

Ferrotitanium, High-Carbon: (Ti 15-18%, C 6-8%). Contract min c.l. $240 per ton, f.o.b. Niagara Falls, N. Y., freight allowed to destinations east of Mississippi River and north of Baltimore and St. Louis. Spot, $245.

Ferrotitanium, Medium-Carbon: (Ti 17-21%, C 2-4%). Contract, c.l. $290 per ton, f.o.b. Niagara Falls, N. Y., freight not exceeding St. Louis rate allowed. Spot, $295.

CHROMIUM ALLOYS

High-Carbon Ferrochrome: Contract, c.l. lump, bulk 28.75c per lb of contained Cr; c.l. packed 30.30c, ton lot 32.05c; less ton 33.45c. Delivered. Spot, add 0.25c.

Low-Carbon Ferrochrome: Cr 63-66% (Simplex), carload, lump, bulk, C 0.025% max, 36.75c per lb contained Cr; 0.010% max, 37.75c. Ton lot, add 3.5c; less ton, add 5.2c. Delivered.

Cr 67-71%, carload, lump, bulk, C 0.02% Max 41.00c per lb contained Cr; 0.025% max, 39.75c; 0.05% max, 39.00c; 0.10% max, 38.50c; 0.20% max, 38.25c; 0.50% max, 38.00c; 1.0% max, 37.75c; 1.5% max, 37.50c; 2.0% max, 37.25c. Ton lot, add 3.4c; less ton lot, add 5.1c. Delivered.

Foundry Ferrochrome, High-Carbon: (Cr 61-66%, C 5-7%, Si 7-10%). Contract, c.l., 2 in. x D, bulk 30.8c per lb of contained Cr. Packed, c.l. 32.4c, ton 34.2c, less ton 35.7c. Delivered. Spot, add 0.25c.

Foundry Ferrosilicon Chrome: (Cr 50-54%, Si 28-32%, C 1.25% max). Contract, carload packed 8M x D, 21.25c per lb of alloy, ton lot 22.50c; less ton lot 23.70c. Delivered. Spot, add 0.25c.

Ferrochrome-Silicon: Cr 39-41%, Si 42.45%, C 0.05% max or Cr 33-36%, Si 45-48%, C 0.05% max. Carload, lump, bulk, 3" x down and 2" x down, 28.25c per lb contained Cr, 14.60c per lb contained Si, 0.75" x down 29.40c per lb contained Cr, 14.60c per lb contained Si.

Chromium Metal, Electrolytic: Commercial grade, (Cr 99.8% min, metallic basis, Fe 0.2% max). Contract, carlot, packed 2" x D plate (about ⅛" thick) $1.15 per lb, ton lot $1.17, less ton lot $1.19. Delivered. Spot, add 5c.

VANADIUM ALLOYS

Ferrovanadium: Open-hearth grade (V 50-55%, Si 8% max, C 3% max). Contract, any quantity, $3.20 per lb of contained V. Delivered. Spot, add 10c. **Special Grade:** (V 50-55% or 70-75%, Si 2% max, C 0.5% max) $3.30. **High Speed Grade:** (V 50-55% or 70-75%, Si 1.50% max, C 0.20% max) $3.40.

Grainal: Vanadium Grainal No. 1 $1.05 per lb; No. 79, 50c, freight allowed.

Vanadium Oxide: Contract less carload lot, packed, $1.38 per lb contained V_2O_5, freight allowed. Spot, add 5c.

SILICON ALLOYS

50% Ferrosilicon: Contract, carload, lump, bulk, 14.6c per lb of contained Si. Packed c.l. 17.1c, ton lot 18.55c, less ton 20.20c, f.o.b. Alloy, W. Va.; Ashtabula, Marietta, O.; Sheffield, Ala.; Portland, Oreg. Spot, add 0.45c.

Low-Aluminum 50% Ferrosilicon: (Al 0.40% max). Add 1.45c to 50% ferrosilicon prices.

65% Ferrosilicon: Contract, carload, lump, bulk, 15.75c per lb contained silicon. Packed, c.l. 17.75c, ton lot 19.55c, less ton 20.9c. Delivered. Spot, add 0.35c.

75% Ferrosilicon: Contract, carload, lump, bulk, 16.9c per lb of contained Si. Packed, c.l. 18.8c, ton lot 20.45c, less ton 21.7c. Delivered. Spot, add 0.3c.

90% Ferrosilicon: Contract, carload, lump, bulk, 20c per lb of contained Si. Packed, c.l. 21.65c, ton lot 23.05c, less ton 24.1c. Delivered. Spot, add 0.25c.

Silicon Metal: (98% min Si, 1.00% max Fe, 0.07% max Ca). C.l. lump, bulk, 21.5c per lb of Si. Packed c.l. 23.15c, ton lot 24.45c, less ton 25.45c. Add 0.5c for max 0.03% Ca grade. Add 0.5c for 0.50% Fe grade analyzing min 98.25% min Si.

Alsifer: (Approx 20% Al, 40% Si, 40% Fe). Contract, basis f.o.b. Niagara Falls, N. Y., lump, carload, bulk, 9.85c per lb of alloy; ton lot, packed, 10.85c.

Scrapmen Expect First Quarter Rise

STEEL's composite on the prime grade holds unchanged at $39.66 at start of new year, but rising steelmaking operations will put new strength into the market

Scrap Prices, Page 460

Pittsburgh—Prices are firmer following the recent mill purchase of more than 20,000 tons of scrap to be shipped this month. No. 1 heavy melting is quoted at $43; No. 2 heavy melting at $36; No. 2 dealer bundles, $32.

Sellers expect the rising trend to continue as the mills step up operations.

Bidding on railroad and industrial lists is expected to be brisk this month, but dealers think price increases will be modest because of the large tonnages offered.

Chicago—Yearend activity in the scrap market was at low ebb, with buying extremely light and prices stable. Ordering is so scant the market isn't getting a thorough test. Material is in abundant supply, and eight steel plant blast furnaces are idle; both factors tend to subdue optimism of scrap dealers and brokers for the early weeks of the new year.

Cleveland—On the basis of a bid of $42.50 on an automotive list of 115 cars, the price of factory bundles should be $44-$45, delivered. But brokers feel this bid is not representative of the market, especially with other lists about to be closed. Since there is no consumer buying to determine the level of delivered prices, quotations are unchanged but nominal on the basis of heavy melting at $38.50-$39.50, Cleveland, and $42-$43, Valley.

Buffalo—Holiday influences slowed trading to a walk. Prices are steady, and sentiment appears to be a little stronger. Some market observers think quotations might go up a little this month, largely because of higher prices at other consuming points.

Youngstown—The market is dull here. No new orders have appeared, and none are in sight. Dealers are hopeful that rising steel demand may force steelmakers to resume buying scrap to support furnace operations.

Cincinnati—A stronger tone is developing in the market. New strength is expected to show up in bidding on industrial lists. Some new mill buying is anticipated. Prices are unchanged, but there's some talk that brokers' buying prices on the principal steelmaking grades may be raised $1.

St. Louis—There was virtually no activity in this market over the holidays. Some pickup in buying is expected this month, and dealers are hoping for a price advance.

Houston—The local mill entered the market just before the year ended for a limited tonnage of January delivery scrap at prices sharply down from those paid in November. Result: Broker buying prices dropped as much as $7 a ton on No. 1 heavy melting.

No Gulf export buying is projected this month. Mexican demand for Texas scrap is limited to small tonnages of low priced No. 2 bundles.

Birmingham — Scrap consumers are not expected to resume buying until the middle of this month. Tonnage on old orders will continue to move. Virtually all market factors anticipate lower prices when buying resumes. A strike at the Atlanta steel mill continues. The export market is quiet.

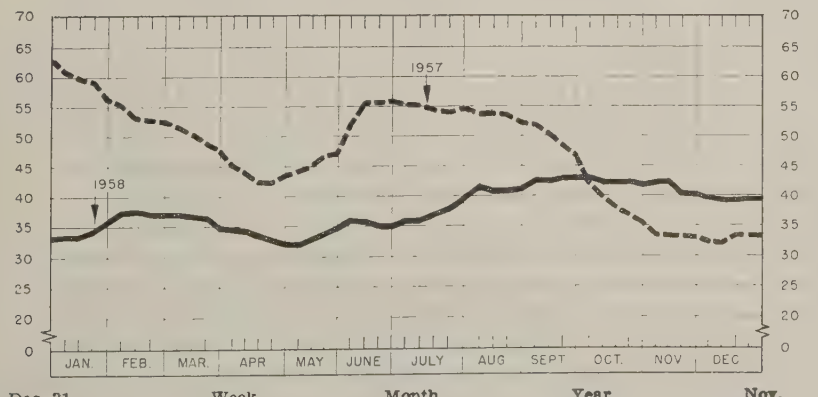
Los Angeles — Prices are unchanged, but they show signs of softening. Some dealers anticipate a $2 to $3 decline this month. Five or six cargoes are expected to sail for Japan from this port during the first quarter.

Seattle—Dealers are hoping for an upturn in demand over coming weeks, but current steelmaking operations do not offer much encouragement. Large consumers are well stocked, so that any upswing in steelmaking would not force them to start buying scrap in volume.

San Francisco — There's little movement of scrap here, except for tonnage committed for export. As a result, the price structure is uncertain, and there is considerable doubt that current quotations will hold.

STEELMAKING SCRAP PRICE COMPOSITE

Based on No. 1 heavy melting grade at Pittsburgh, Chicago, and eastern Pennsylvania—Compiled by STEEL.



Dec. 31 1958	Week Ago	Month Ago	Year Ago	Nov. Avg
$39.66	$39.66	$40.33	$33.17	$41.42

Scrap's Outlook Brighter

Improved prospects for steel production in 1959 encourage scrapmen to anticipate substantial improve-

(*Please turn to Page* 466)

Iron and Steel Scrap

Consumer prices per gross ton, except as otherwise noted, including brokers' commission, as reported to STEEL, Dec. 31, 1958. *Changes shown in italics.*

STEELMAKING SCRAP COMPOSITE

Dec. 31	$39.66
Dec. 24	39.66
Nov. Avg.	41.42
Dec. 1957	32.77
Dec. 1953	36.99

Based on No. 1 heavy melting grade at Pittsburgh, Chicago, and eastern Pennsylvania.

PITTSBURGH

No. 1 heavy melting	42.00-43.00
No. 2 heavy melting	35.00-36.00
No. 1 dealer bundles	43.00-44.00
No. 2 bundles	31.00-32.00
No. 1 busheling	42.00-43.00
No. 1 factory bundles	46.00-47.00
Machine shop turnings	20.00-21.00
Mixed borings, turnings	20.00-21.00
Short shovel turnings	25.00-26.00
Cast iron borings	25.00-26.00
Cut structurals:	
2 ft and under	47.00-48.00
3 ft lengths	46.00-47.00
Heavy turnings	34.00-35.00
Punchings & plate scrap	47.00-48.00
Electric furnace bundles	47.00-48.00

Cast Iron Grades

No. 1 cupola	44.00-45.00
Stove plate	41.00-42.00
Unstripped motor blocks	31.00-32.00
Clean auto cast	39.00-40.00
Drop broken machinery	51.00-52.00

Railroad Scrap

No. 1 R.R. heavy melt.	44.00-45.00
Rails, 2 ft and under	56.00-57.00
Rails, 18 in. and under	57.00-58.00
Random rails	53.00-54.00
Railroad specialties	48.00-49.00
Angles, splice bars	48.00-49.00
Rails, rerolling	58.00-59.00

Stainless Steel Scrap

18-8 bundles & solids	225.00-230.00
18-8 turnings	125.00-130.00
430 bundles & solids	125.00-130.00
430 turnings	55.00-65.00

CHICAGO

No. 1 hvy melt, indus.	43.00-44.00
No. 1 heavy melt dealer	41.00-42.00
No. 2 heavy melting	35.00-36.00
No. 1 factory bundles	46.00-47.00
No. 1 dealer bundles	42.00-43.00
No. 2 bundles	29.00-30.00
No. 1 busheling, indus.	43.00-44.00
No. 1 busheling, dealer	*41.00-42.00*
Machine shop turnings	21.00-22.00
Mixed borings, turnings	23.00-24.00
Short shovel turnings	23.00-24.00
Cast iron borings	23.00-24.00
Cut structurals, 3 ft	47.00-48.00
Punchings & plate scrap	48.00-49.00

Cast Iron Grades

No. 1 cupola	45.00-46.00
Stove plate	43.00-44.00
Unstripped motor blocks	37.00-38.00
Clean auto cast	52.00-53.00
Drop broken machinery	52.00-53.00

Railroad Scrap

No. 1 R.R. heavy melt	45.00-46.00
R.R. malleable	57.00-58.00
Rails, 2 ft and under	58.00-59.00
Rails, 18 in. and under	59.00-60.00
Angles, splice bars	54.00-55.00
Axles	69.00-70.00
Rails, rerolling	62.00-63.00

Stainless Steel Scrap

18-8 bundles & solids	215.00-220.00
18-8 turnings	115.00-120.00
430 bundles & solids	115.00-120.00
430 turnings	45.00-50.00

YOUNGSTOWN

No. 1 heavy melting	42.00-43.00
No. 2 heavy melting	29.00-30.00
No. 1 busheling	42.00-43.00
No. 1 bundles	42.00-43.00
No. 2 bundles	29.00-30.00
Machine shop turnings	15.00-16.00
Short shovel turnings	20.00-21.00
Cast iron borings	20.00-21.00
Low phos	43.00-44.00
Electric furnace bundles	43.00-44.00

Railroad Scrap

N. 1 R.R. heavy melt.	44.00-45.00

CLEVELAND

No. 1 heavy melting	38.50-39.50
No. 2 heavy melting	25.00-26.00
No. 1 factory bundles	43.00-44.00
No. 1 bundles	38.50-39.50
No. 2 bundles	28.50-29.50
No. 1 busheling	38.50-39.50
Machine shop turnings	14.00-15.00
Short shovel turnings	20.00-21.00
Mixed borings, turnings	20.00-21.00
Cast iron borings	20.00-21.00
Cut foundry steel	39.00-40.00
Cut structurals, plates 2 ft and under	47.00-48.00
Low phos, punching & plate	40.00-41.00
Alloy free, short shovel turnings	22.00-23.00
Electric furnace bundles	39.00-40.00

Cast Iron Grades

No. 1 cupola	44.00-45.00
Charging box cast	37.00-38.00
Heavy breakable cast	36.00-37.00
Stove plate	43.00-44.00
Unstripped motor blocks	32.00-33.00
Brake shoes	36.00-37.00
Clean auto cast	49.00-50.00
Burnt cast	33.00-34.00
Drop broken machinery	49.00-50.00

Railroad Scrap

R.R. malleable	63.00-64.00
Rails, 2 ft and under	57.00-58.00
Rails, 18 in. and under	58.00-59.00
Rails, random lengths	52.00-53.00
Cast steel	49.00-50.00
Railroad specialties	50.00-51.00
Uncut tires	43.00-44.00
Angles, splice bars	50.00-51.00
Rails, rerolling	56.00-57.00

Stainless Steel
(Brokers' buying prices; f.o.b. shipping point)

18-8 bundles, solids	205.00-215.00
18-8 turnings	115.00-120.00
430 clips, bundles, solids	110.00-120.00
430 turnings	40.00-50.00

ST. LOUIS

(Brokers' buying prices)

No. 1 heavy melting	37.00
No. 2 heavy melting	35.00
No. 1 bundles	39.00
No. 2 bundles	27.00
No. 1 busheling	39.00
Machine shop turnings	18.50†
Short shovel turnings	20.50†

Cast Iron Grades

No. 1 cupola	48.00
Charging box cast	40.00
Heavy breakable cast	38.00
Unstripped motor blocks	39.00
Clean auto cast	48.00
Stove plate	44.00

Railroad Scrap

No. 1 R.R. heavy melt.	44.00†
Rails, 18 in. and under	51.00†
Rails, random lengths	47.50
Rails, rerolling	59.50
Angles, splice bars	47.00

BIRMINGHAM

No. 1 heavy melting	35.00-36.00
No. 2 heavy melting	28.00-29.00
No. 1 bundles	35.00-36.00
No. 2 bundles	21.00-22.00
No. 1 busheling	35.00-36.00
Cast iron borings	13.00-14.00
Machine shop turnings	21.00-22.00
Short shovel turnings	22.00-23.00
Bars, crops and plates	42.00-43.00
Structurals & plates	41.00-42.00
Electric furnace bundles	37.00-38.00
Electric furnace:	
2 ft and under	36.00-37.00
3 ft and under	35.00-36.00

Cast Iron Grades

No. 1 cupola	53.00-54.00
Stove plate	52.00-53.00
Unstripped motor blocks	40.00-41.00
Charging box cast	29.00-30.00
No. 1 wheels	42.00-43.00

Railroad Scrap

No. 1 R.R. heavy melt.	37.00-39.00
Rails, 18 in. and under	49.00-50.00
Rails, rerolling	54.00-55.00
Rails, random lengths	44.00-45.00
Angles, splice bars	45.00-46.00

PHILADELPHIA

No. 1 heavy melting	34.00
No. 2 heavy melting	31.00
No. 1 bundles	35.00
No. 2 bundles	24.50
No. 1 busheling	34.00
Electric furnace bundles	37.00
Mixed borings, turnings	18.00†
Short shovel turnings	21.00-22.00
Machine shop turnings	18.00
Heavy turnings	30.00
Structurals & plate	39.00-40.00
Couplers, springs, wheels	42.00-43.00
Rails, crops, 2 ft & under	56.00-57.00

Cast Iron Grades

No. 1 cupola	39.00
Heavy breakable cast	41.00
Malleable	62.00
Drop broken machinery	48.00-49.00

NEW YORK

(Brokers' buying prices)

No. 1 heavy melting	27.00-28.00
No. 2 heavy melting	24.00-25.00
No. 1 bundles	27.00-28.00
No. 2 bundles	17.00-18.00
Machine shop turnings	9.00-10.00
Mixed borings, turnings	10.00-11.00
Short shovel turnings	13.00-14.00
Low phos. (structurals & plates)	33.00-34.00

Cast Iron Grades

No. 1 cupola	34.00-35.00
Unstripped motor blocks	23.00-24.00
Heavy breakable	31.00-32.00

Stainless Steel

18-8 sheets, clips, solids	185.00-190.00
18-8 borings, turnings	85.00-90.00
410 sheets, clips, solids	55.00-60.00
430 sheets, clips, solids	75.00-80.00

BUFFALO

No. 1 heavy melting	33.00-34.00
No. 2 heavy melting	27.00-28.00
No. 1 bundles	33.00-34.00
No. 2 bundles	25.00-26.00
No. 1 busheling	33.00-34.00
Mixed borings, turnings	17.00-18.00
Machine shop turnings	15.00-16.00
Short shovel turnings	19.00-20.00
Cast iron borings	17.00-18.00
Low phos. structurals and plate, 2 ft and under	42.00-43.00

Cast Iron Grades
(F.o.b. shipping point)

No. 1 cupola	44.00-45.00
No. 1 machinery	48.00-49.00

Railroad Scrap

Rails, random lengths	47.00-48.00
Rails, 3 ft and under	53.00-54.00
Railroad specialties	42.00-43.00

CINCINNATI

(Brokers' buying prices; f.o.b. shipping point)

No. 1 heavy melting	37.00-38.00
No. 2 heavy melting	32.00-33.00
No. 1 bundles	37.00-38.00
No. 2 bundles	25.00-26.00
No. 1 busheling	37.00-38.00
Machine shop turnings	18.00-19.00
Mixed borings, turnings	19.00-20.00
Short shovel turnings	21.00-22.00
Cast iron borings	19.00-20.00
Low phos, 18 in.	46.00-47.00

Cast Iron Grades

No. 1 cupola	45.00-46.00
Heavy breakable cast	38.00-39.00
Charging box cast	38.00-39.00
Drop broken machinery	47.00-48.00

Railroad Scrap

No. 1 R.R. heavy melt.	42.00-43.00
Rails, 18 in. and under	55.00-56.00
Rails, random lengths	49.00-50.00

HOUSTON

(Brokers' buying prices; f.o.b. cars)

No. 1 heavy melting	*33.00*
No. 2 heavy melting	*30.00*
No. 1 bundles	*33.00*
No. 2 bundles	*23.00†*
Machine shop turnings	17.00
Short shovel turnings	20.00
Low phos. plates & structurals	*39.00†*

Cast Iron Grades

No. 1 cupola	43.00
Heavy breakable	27.00-28.00†
Foundry malleable	37.00
Unstripped motor blocks	33.00

Railroad Scrap

No. 1 R.R. heavy melt.	*33.00†*

BOSTON

(Brakers' buying prices; f.o.b. shipping point)

No. 1 heavy melting	25.00-26.00
No. 2 heavy melting	20.00-21.00
No. 1 bundles	25.00-26.00
No. 1 busheling	25.00-26.00
Machine shop turnings	7.00-8.00
Short shovel turnings	10.00-11.00
No. 1 cast	33.00
Mixed cupola cast	33.00
No. 1 machinery cast	34.00

DETROIT

(Brokers' buying prices; f.o.b. shipping point)

No. 1 heavy melting	34.00-35.00
No. 2 heavy melting	21.00-22.00
No. 1 bundles	35.00-36.00
No. 2 bundles	22.00-23.00
No. 1 busheling	34.00-35.00
Machine shop turnings	13.00-14.00
Mixed borings, turnings	14.00-15.00
Short shovel turnings	15.00-16.00
Punching & plate	37.00-38.00

Cast Iron Grades

No. 1 cupola	44.00-45.00
Stove plate	34.00-35.00
Charging box cast	34.00-35.00
Heavy breakable	35.00-36.00
Unstripped motor blocks	19.00-20.00
Clean auto cast	49.00-50.00

SEATTLE

No. 1 heavy melting	31.00
No. 2 heavy melting	29.00
No. 1 bundles	29.00
No. 2 bundles	23.00
Machine shop turnings	9.00-10.00†
Mixed borings, turnings	9.00-10.00†
Electric furnace No. 1	38.00†

Cast Iron Grades

No. 1 cupola	31.00†
Heavy breakable cast	28.00†
Unstripped motor blocks	23.00†
Stove plate (f.o.b. plant)	21.00†

LOS ANGELES

No. 1 heavy melting	33.00
No. 2 heavy melting	35.00
No. 1 bundles	34.00
No. 2 bundles	20.00
Machine shop turnings	15.00
Shoveling turnings	18.00
Cast iron borings	15.00
Cut structurals and plate 1 ft and under	48.00

Cast Iron Grades
(F.o.b. shipping point)

No. 1 cupola	47.00

Railroad Scrap

No. 1 R.R. heavy melt.	38.00

SAN FRANCISCO

No. 1 heavy melting	32.00-34.00
No. 2 heavy melting	30.00-32.00
No. 1 bundles	30.00-32.00
No. 2 bundles	22.00
Machine shop turnings	15.00
Mixed borings, turnings	15.00
Cast iron borings	15.00
Heavy turnings	15.00
Short shovel turnings	15.00
Cut structurals, 3 ft	40.00

Cast Iron Grades

No. 1 cupola	44.00
Charging box cast	34.00
Stove plate	34.00
Heavy breakable cast	28.00
Unstripped motor blocks	31.00
Clean auto cast	40.00
Drop broken machinery	40.00
No. 1 wheels	34.00

HAMILTON, ONT.*

No. 1 heavy melting	34.50
No. 2 heavy melting	30.50
No. 1 bundles	34.50
No. 2 bundles	25.00
Mixed steel scrap	26.50
Mixed borings, turnings	15.00
Busheling, new factory:	
Prepared	34.50
Unprepared	28.50
Short steel turnings	19.00

Cast Iron Grades‡

No. 1 machinery cast	39.00-41.00

*Brokers' buying prices.
†Nominal.
‡F.o.b. Hamilton, Ont.

THE NEW LOGEMANN MODEL 500-PF HIGH SPEED SCRAP PRESS

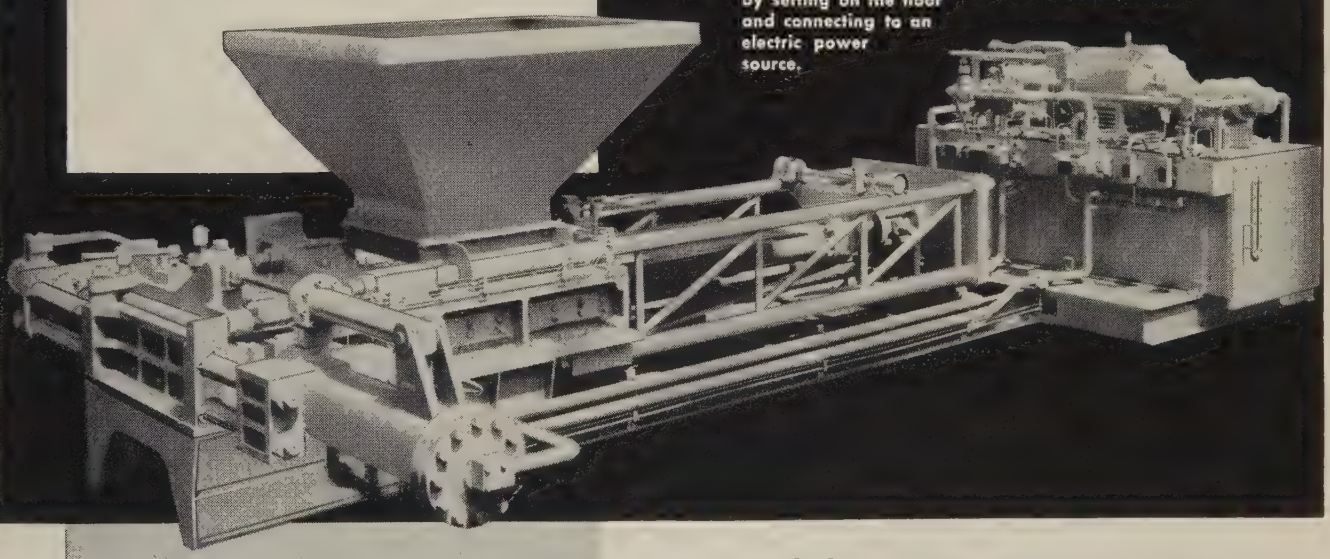
FAST LOADING! FAST BALING! FAST DISCHARGE!

Here is a two-compression, side-ejection press designed for high production — up to 240 bales per hour.

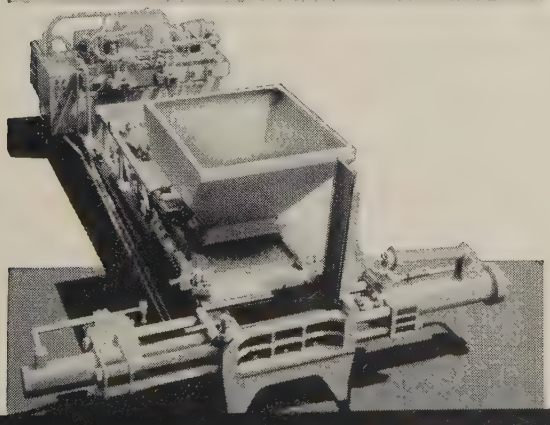
It is able to bale sheet clips, stamping skeletons, wire, cans, steel, copper, brass and aluminum scrap.

No pit required for installation. Can be operated by setting on the floor and connecting to an electric power source.

The **LOGEMANN Model 500-PF** press is a high-speed, high-density horizontal two compression unit. It is filled from a hopper supermounted above the compression box and discharges the compressed bale through a side opening. The operating cycle is automatic and continuous, or manual at the option of the operator.



BALE SIZE	6" x 12" x 8" (VARIABLE)
BALE WEIGHT	40 LBS. AVERAGE
PRODUCTION	UP TO 240 BALES PER HOUR



Designed for HIGH PRODUCTION

Here is a new high speed scrap press . . . geared for high production and extra baling profits for you. Famous "engineered" features, proved through actual operation, are built into this press to give you constant, uninterrupted service. It's a top-loading side-ejection press that can handle a variety of scrap. Write for the new Bulletin No. 220; it will give you complete information concerning design, pumping unit, valve assembly and accessory equipment. When making your inquiries please state the nature of your scrap and the tonnage desired.

LOGEMANN BROTHERS CO.

3126 W. BURLEIGH STREET • MILWAUKEE 45, WISCONSIN

Metalmen See Good Year

Here's what to expect: Demand will go up; prices will be more stable than in prior years. Supplies will be adequate although it may take longer to get orders filled

Nonferrous Metal Prices, Pages 464 & 465

PRODUCERS of nonferrous metals haven't been so optimistic in months. They've just come through one of their best fourth quarters in history and have little reason to expect a slowup in 1959. If the economy forges ahead at predicted levels over the next 12 months, over-all industry sales will equal those of 1957.

A few metals stand a fighting chance of bettering the 1957 mark.

Even the pessimists admit 1959 won't be a dull year. Here's a rundown on what to expect:

Copper

• **Output**—Look for Free World refined production to rise sharply. It could go to around 3.3 million tons, vs. an estimated 2.75 million tons in 1958. Most U. S. mines are operating at capacity, and the increased output should begin to be felt in the market soon. This country may have to import up to 250,000 tons of blister or refined copper in 1959 to meet demand.

• **Business** — Overseas sales will hold at close to 1958 levels with a slight chance of a mild dropoff. It's a different story in the U. S. Estimates peg American shipments at 10 to 20 per cent better than 1958's. Look for foreign sales to approach the 1.7 million ton mark estimated for 1958. U. S. sales should be around 1.4 million tons, compared with an estimated 1.2 million tons in 1958.

• **Supply**—With a stepup in both supply and demand anticipated, the 1959 copper market should be pretty well balanced. It's doubtful if producers' stocks will go much lower —they're now close to what's considered to be minimum working levels. Don't be surprised if you have to allow for a little more leadtime on orders.

• **Price**—Adequate supplies and a fairly stable business picture should protect consumers from the price flip-flops of the past. Outlook: Stability, with the price probably rising to 30 cents a pound during the year. Keep one factor in mind: Most producers have labor contracts that terminate in 1959. A prolonged strike would bring a shortage and price gyrations similar to those of 1954.

Aluminum

• **Output**—U. S. primary production in 1959 should hit at least 1.7 to 1.8 million tons, vs. an estimated 1.55 million tons in 1958. Secondary recovery, which fell about 18 per cent to an estimated 380,000 tons in 1958, should also gain. Market conditions are still too hazy to forecast imports, but they should at least equal the 1958 estimate of 230,000 tons.

• **Business**—Forecasts peg a rise in consumption of 10 to 24 per cent this year. Besides the over-all business improvement, major reasons are the greater quantities going into cars (Kaiser says Detroit will increase usage by 50 per cent), more penetration of the housing field, and scores of new and expanded uses. (The industry plans to spend $30 million on research and development in 1959.) Here's another factor: Consumption in 1958 was better than shipments to consumers indicate (1.8 million tons shipped in 1958, compared with 1.925 million tons in 1957).

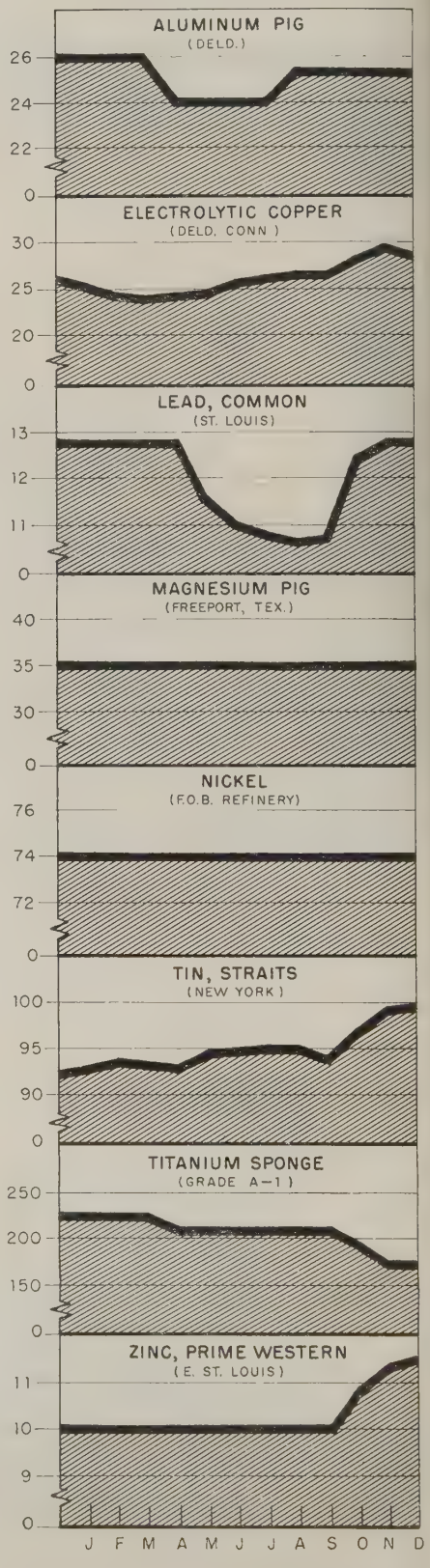
• **Supply**—Availability is more than adequate to meet demand. U. S. primary capacity is 2.15 million tons now and will rise to 2.45 million tons by the end of this year.

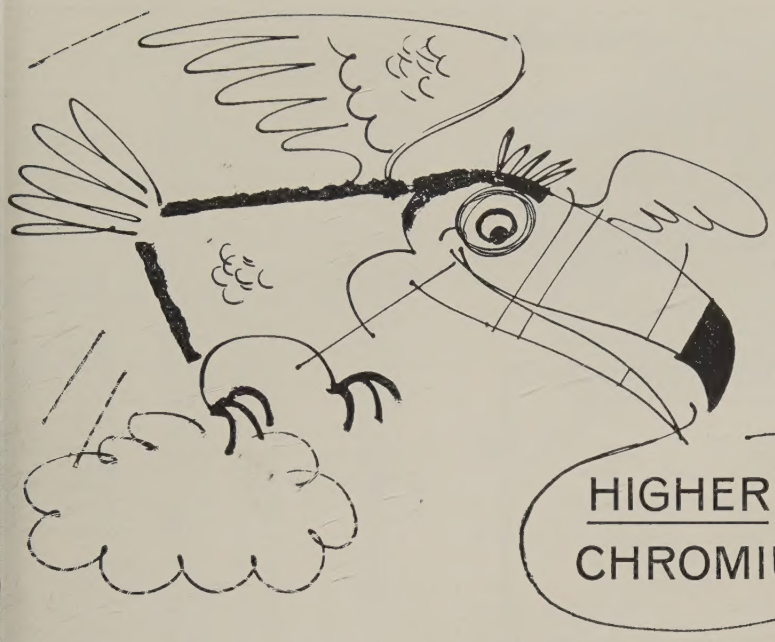
• **Price** — Producers have already guaranteed that there will be no price increases through the first half. If business is anywhere near present levels, you can expect a hike soon after midyear.

Next Week: Outlook for other nonferrous metals in 1959.

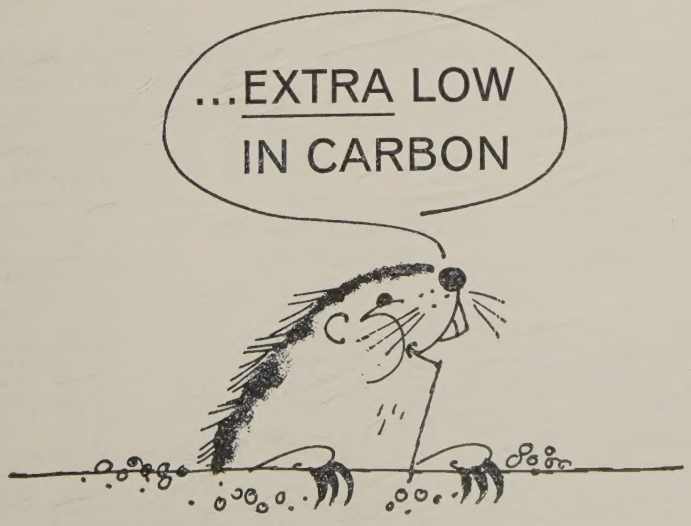
How Prices Went in '58

(Cents per pound)





EXLO® "75"



Now, from VCA's integrated, mine-to-mill facilities, come two new members of the EXLO ferrochromium family, with higher-than-ever chromium content (75% minimum) for use in very low carbon stainless steels and heat-resistant alloys. EXLO "75" is particularly adaptable to vacuum melting...and to other processes where maximum cleanliness is a *must!* Two grades of EXLO "75" to choose from:

Max. .015% Carbon Grade

Chromium .....min. 75%
Carbon .....max. 0.015%
Silicon .....max. 0.75%

Max. .025% Carbon Grade

Chromium .....min. 75%
Carbon .....max. 0.025%
Silicon .....max. 0.75%

AND BEAR IN MIND the *regular* EXLO grades for use in low carbon stainless and heat-resistant steels, irons and alloys. These, like all EXLO ferrochromium alloys, have high density and exceptional cleanliness.

Max. .025% Carbon Grade

Chromium 68/73%
Carbon .....max. 0.025%
Silicon .....max. 0.75%

Max. .05% Carbon Grade

Chromium 68/73%
Carbon .....max. 0.05%
Silicon .....max. 0.75%

Learn more about the substantial advantages of the whole EXLO family of fine high chromium—extra low carbon alloys. Call your VCA representative—or write us—today!

VANCORAM

VANADIUM CORPORATION OF AMERICA

420 Lexington Avenue
New York 17, New York
Chicago • Cleveland • Detroit • Pittsburgh
Producers of alloys, metals and chemicals

Nonferrous Metals

Cents per pound, carlots except as otherwise noted.

PRIMARY METALS AND ALLOYS

Aluminum: 99.5%, pigs, 24.70; ingots, 26.80, 30,000 lb or more, f.o.b. shipping point. Freight allowed on 500 lb or more.

Aluminum Alloy: No. 13, 28.60; No. 43, 28.40; No. 195, 29.40; No. 214, 30.20; No. 356, 28.60; 30 or 40 lb ingots.

Antimony: R.M.M. brand, 99.5%, 29.00; Lone Star brand, 29.50, f.o.b. Laredo, Tex., in bulk. Foreign brands, 99.5%, 24.50-25.00, New York, duty paid, 10,000 lb or more.

Beryllium: 97% lump or beads, $71.50 per lb, f.o.b. Cleveland or Reading, Pa.

Beryllium Aluminum: 5% Be, $74.75 per lb of contained Be, with balance as Al at market price, f.o.b. shipping point.

Beryllium Copper: 3.75-4.75% Be, $43 per lb of contained Be, with balance as Cu at market price on shipment date, f.o.b. shipping point.

Bismuth: $2.25 per lb, ton lots.

Cadmium: Sticks and bars, $1.45 per lb deld.

Cobalt: 97.99%, $2.00 per lb for 550-lb keg; $2.02 per lb for 100 lb case; $2.07 per lb under 100 lb.

Columbium: Powder, $55-85 per lb, nom.

Copper: Electrolytic, 29.00 deld.; custom smelters, 29.00; lake, 29.00 deld.; fire refined, 28.75 deld.

Germanium: First reduction, $179.17-197.31 per lb; intrinsic grade, $197.31-220 per lb, depending on quantity.

Gold: U. S. Treasury, $35 per oz.

Indium: 99.9%, $2.25 per troy oz.

Iridium: $70-80 nom. per troy oz.

Lead: Common, 12.80; chemical, 12.90; corroding, 12.90, St. Louis. New York basis, add 0.20.

Lithium: 98 + %, 50-100 lb, cups or ingots, $12; rod, $15; shot or wire, $16. 100-500 lb, cups or ingots, $10.50; rod, $14; shot or wire, $15, f.o.b. Minneapolis.

Magnesium: Pig, 35.25; ingot, 36.00 f.o.b. Velasco, Tex.; 12 in. sticks, 59.00 f.o.b. Madison, Ill.

Magnesium Alloys: AZ91A (diecasting), 40.75 deld.; AZ63A, AZ92A, 9Z91C (sand casting), 40.75, f.o.b. Velasco, Tex.

Mercury: Open market, spot, New York, $221-224 per 76-lb flask.

Molybdenum: Unalloyed, turned extrusion, 3.75-5.75 in. round, $9.60 per lb in lots of 2500 lb or more, f.o.b. Detroit.

Nickel: Electrolytic cathodes, sheets (4 x 4 in. and larger), unpacked, 74.00; 10-lb pigs, unpacked, 78.25; "XX" nickel shot, 79.50; "F" nickel shot for addition to cast iron, 74.50; "F" nickel, 5 lb ingots in kegs for addition to cast iron, 75.50. Prices f.o.b. Port Colborne, Ont., including import duty. New York basis, add 1.01. Nickel oxide sinter at Buffalo, New York, or other established U. S. points of entry, contained nickel, 69.60.

Osmium: $70-100 per troy oz nom.

Palladium: $15-17 per troy oz.

Platinum: $52-55 per troy oz from refineries.

Radium: $16-21.50 per mg radium content, depending on quantity.

Rhodium: $118-125 per troy oz.

Ruthenium: $45-55 per troy oz.

Selenium: $7.00 per lb, commercial grade.

Silver: Open market, 89.875 per troy oz.

Sodium: 17.00 c.l.; 19.00-19.50 l.c.l.

Tantalum: Rod, $60 per lb; sheet, $55 per lb.

Tellurium: $1.65-1.85 per lb.

Thallium: $7.50 per lb.

Tin: Straits, N. Y., spot and prompt, 98.75.

Titanium: Sponge, 99.3 + % grade A-1, ductile (0.3% Fe max.), $1.62-1.82; grade A-2 (0.5% Fe max.),$1.70 per lb.

Tungsten: Powder, 89.8%, carbon reduced, 1000-lb lots, $3.15 per lb nom., f.o.b. shipping point; less than 1000 lb, add 15.00; 99 + % hydrogen reduced, $3.30-3.80.

Zinc: Prime Western, 11.50; brass special, 11.75; intermediate, 12.00, East St. Louis, freight allowed over 0.50 per lb. New York basis, add 0.50. High grade, 12.50; special high grade, 12.75 deld. Diecasting alloy ingot No. 3, 14.00; No. 2, 14.25; No. 5, 14.50 deld.

Zirconium: Reactor grade sponge, 100 lb or less, $7 per lb; 100-500 lb, $6.50 per lb; over 500 lb, $6 per lb.

(Note: Chromium, manganese, and silicon metals are listed in ferroalloy section.)

SECONDARY METALS AND ALLOYS

Aluminum Ingot: Piston alloys, 23.875-25.25; No. 12 foundry alloy (No. 2 grade), 21.75-22.00; 5% silicon alloy, 0.60 Cu max., 24.75-25.00; 13 alloy 0.60 Cu max., 24.75-25.00; 195 alloy, 25.25-26.00; 108 alloy, 22.25-22.50. Steel deoxidizing grades, notch bars, granulated or shot: Grade 1, 23.50; grade 2, 22.00; grade 3, 21.00; grade 4, 19.00.

Brass Ingot: Red brass, No. 115, 28.00; tin bronze, No. 225, 37.50; No. 245, 32.25; high-leaded tin bronze, No. 305, 32.25; No. 1 yellow, No. 405, 23.00; manganese bronze, No. 421, 24.75.

Magnesium Alloy Ingot: AZ63A, 37.50; AZ91B, 37.50; AZ91C, 41.25; AZ92A, 37.50.

NONFERROUS PRODUCTS

BERYLLIUM COPPER

(Base prices per lb, plus mill extras, 2000 to 5000 lb; nom. 1.9% Be alloy.) Strip, $1.885, f.o.b. Temple, Pa., or Reading, Pa.; rod, bar, wire, $1.865, f.o.b. Temple, Pa.

COPPER WIRE

Bare, soft, f.o.b. eastern mills, 20,000-lb lots, 34.35; l.c.l., 34.98. Weatherproof, 20,000-lb lots, 35.54; l.c.l., 36.29.

LEAD

(Prices to jobbers, f.o.b. Buffalo, Cleveland, Pittsburgh.) Sheets, full rolls, 140 sq ft or more, $18.50 per cwt; pipe, full coils, $18.50 per cwt; traps and bends, list prices plus 30%.

TITANIUM

(Prices per lb, 10,000 lb and over, f.o.b. mill.) Sheets and strip, $8.50-15.95; sheared mill plate, $6.00-9.50; wire, $6.50-10.50; forging billets, $3.80-4.35; hot-rolled and forged bars, $5.10-6.25.

ZINC

(Prices per lb, c.l., f.o.b. mill.) Sheets, 26.00; ribbon zinc in coils, 21.50; plates, 20.00.

ZIRCONIUM

Plate, $12.50-19.20; H.R. strip, $12.50-22.90; C.R. strip, $15.90-31.25; forged or H.R. bars, $11.00-17.40.

NICKEL, MONEL, INCONEL

	"A" Nickel	Monel	Inconel
Sheets, C.R.	126	106	128
Strip, C.R.	124	108	138
Plate, H.R.	120	105	121
Rod, Shapes, H. R.	107	89	109
Seamless Tubes	157	129	200

ALUMINUM

Sheets: 1100, 3003, and 5005 mill finish (30,000 lb base; freight allowed).

Thickness Range, Inches	Flat Sheet	Coiled Sheet
0.250-0.136	42.80-47.30	.....
0.136-0.096	43.20-48.30	.....
0.126-0.103	.....	39.20-39.80
0.096-0.077	43.80-50.00	39.30-40.00
0.077-0.068	44.30-52.20	.....
0.077-0.061	.....	39.50-40.70
0.068-0.061	44.30-52.20	.....
0.061-0.048	44.90-54.40	40.10-41.80
0.048-0.038	45.40-57.10	40.60-43.20
0.038-0.030	45.70-62.00	41.00-45.70
0.030-0.024	46.20-53.70	41.30-45.70
0.024-0.019	46.90-56.80	42.40-44.10
0.019-0.017	47.70-54.10	43.00-44.70
0.017-0.015	48.60-55.00	43.80-45.50
0.015-0.014	49.60	44.80-46.50
0.014-0.012	50.80	45.50
0.012-0.011	51.80	46.70
0.011-0.0095	53.50	48.10
0.0095-0.0085	54.60	49.60
0.0085-0.0075	56.20	50.80
0.0075-0.007	57.70	52.30
0.007-0.006	59.30	53.70

ALUMINUM (continued)

Plates and Circles: Thickness 0.250-3 in. 24-60 in. width or diam., 72-240 in. lengths.

Alloy	Plate Base	Circle Base
1100-F, 3003-F	42.40	47.20
5050-F	43.50	48.30
3004-F	44.50	50.20
5052-F	45.10	50.90
6061-T6	45.60	51.70
2024-T4	49.30	56.10
7075-T6*	57.60	64.70

*24-48 in. width or diam., 72-180 in. lengths

Screw Machine Stock: 30,000 lb base.

Diam. (in.) or across flats*	Round 2011-T3	Round 2017-T4	Hexagonal 2011-T3	Hexagonal 2017-T4
0.125	76.90	73.90	....	....
0.250	62.00	60.20	89.10	76.60
0.375	61.20	60.00	73.50	68.50
0.500	61.20	60.00	73.50	68.50
0.625	61.20	60.00	69.80	64.20
0.750	59.70	58.40	63.60	60.40
0.875	59.70	58.40	63.60	60.40
1.000	59.70	58.40	63.60	60.40
1.125	57.30	56.10	61.50	58.30
1.250	57.30	56.10	61.50	58.30
1.350	57.30	56.10	61.50	58.30
1.500	57.30	56.10	61.50	58.30
1.625	55.00	53.60	....	56.20
1.750	55.00	53.60	60.30	56.20
1.875	55.00	53.60	....	56.20
2.000	55.00	53.60	60.30	56.20
2.125	53.50	52.10	....	....
2.250	53.50	52.10	....	56.20
2.375	53.50	52.10	....	....
2.500	53.50	52.10	....	56.20
2.625	....	50.40	....	....
2.750	51.90	50.40	....	56.20
2.875	....	50.40	....	....
3.000	51.90	50.40	....	56.20
3.125	....	50.40	....	....
3.250	....	50.40	....	....
3.375	....	50.40	....	....

*Selected sizes.

Forging Stock: Round, Class 1, random lengths, diam. 0.375-8 in., "F" temper; 2014, 42.20-55.00; 6061, 41.60-55.00; 7075, 61.60-75.00; 7070, 66.60-80.00.

Pipe: ASA schedule 40, alloy 6063-T6 standard length, plain ends, 90,000 lb base, dollars per 100 ft. Nominal pipe sizes: ¾ in., 18.85 1 in., 29.75; 1¼ in., 40.30; 1½ in., 48.15; 2 in., 58.30; 4 in., 160.20; 6 in., 287.55; 8 in., 432.70.

Extruded Solid Shapes:

Factor	Alloy 6063-75	Alloy 6062-T6
9-11	42.70-44.20	51.30-55.50
12-14	42.70-44.20	52.00-56.50
15-17	42.70-44.20	53.20-58.20
18-20	43.20-44.70	55.20-60.80

MAGNESIUM

Sheet and Plate: AZ31B standard grade, 0.32 in., 103.10; .081 in., 77.90; .125 in., 70.40; .188 in., 69.00; .250-2.0 in., 67.90. AZ31B spec. grades, .032 in., 171.30; .081 in., 108.70; .125 in., 98.10; .188 in., 95.70; .250-2.00 in., 93.30. Tread plate, 60-192 in. lengths, 24-72 in. widths; .125 in., 74.90; .188 in., 71.70-72.10; .25-.75 in., 70.60-71.60. Tooling plate, .25-.30 in., 7300.

Extruded Solid Shapes:

Factor	Com. Grade (AZ31C)	Spec. Grade (AZ31B)
6-8	69.60-72.40	84.60-87.40
12-14	70.70-73.00	85.70-88.00
24-26	75.60-76.30	90.60-91.30
36-38	89.20-90.30	104.20-105.30

NONFERROUS SCRAP

DEALER'S BUYING PRICES

(Cents per pound, New York, in ton lots.)

Copper and Brass: No. 1 heavy copper and wire, 22.50-23.00; No. 2 heavy copper and wire, 20.50-21.00; light copper, 18.25-18.75; No. 1 composition red brass, 16.50-17.00; No. 1 com-

BRASS MILL PRICES

	MILL PRODUCTS a				SCRAP ALLOWANCES e (Based on copper at 29.00c)		
	Sheet, Strip, Plate	Rod	Wire	Seamless Tubes	Clean Heavy	Rod Ends	Clean Turnings
Copper	53.13b	50.36c	....	53.39	25.000	25.000	24.250
Yellow Brass	46.57	31.22d	47.11	49.98	17.000	16.750	15.250
Low Brass, 80%	49.23	49.17	48.87	52.54	21.250	21.000	20.500
Red Brass, 85%	50.17	50.11	50.71	53.48	22.125	21.875	21.375
Com. Bronze, 90%	51.65	51.59	52.19	54.71	22.875	22.625	22.125
Manganese Bronze	54.98	48.58	59.08	....	17.750	17.500	16.875
Muntz Metal	49.35	44.66	....	....	17.875	17.625	17.125
Naval Brass	51.24	45.05	57.80	54.65	17.625	17.375	16.875
Silicon Bronze	58.27	57.46	57.81	75.95	24.625	24.625	23.625
Nickel Silver, 10%	62.20	66.60	64.03	....	23.875	23.625	11.937
Phos. Bronze	72.59	73.09	72.59	74.27	25.875	25.625	24.625

a. Cents per lb, f.o.b. mill; freight allowed on 500 lb or more. b. Hot-rolled. c. Cold-drawn. d. Free cutting, e. Prices in cents per lb for less than 20,000 lb, f.o.b. shipping point. On lots over 20,000 lb at one time, of any or all kinds of scrap, add 1 cent per lb.

position turnings, 15.50-16.00; new brass clippings, 14.00-14.50; light brass, 10.50-11.00; heavy yellow brass, 11.50-12.00; new brass rod ends, 12.50-13.00; auto radiators, unsweated, 13.50-14.00; cocks and faucets, 13.50-14.00; brass pipe, 13.50-14.00.

Lead: Heavy, 8.25-8.75; battery plates, 3.25-3.75; linotype and stereotype, 10.50-11.00; electrotype, 9.00-9.50; mixed babbitt, 9.50-10.00.

Monel: Clippings, 30.00-31.00; old sheets, 27.00-28.00; turnings, 22.00-23.00; rods, 30.00-31.00.

Nickel: Sheets and clips, 52.00-55.00; rolled anodes, 52.00-55.00; turnings, 37.00-40.00; rod ends, 52.00-55.00.

Zinc: Old zinc, 4.00-4.25; new diecast scrap, 3.75-4.00; old diecast scrap, 2.50-2.75.

Aluminum: Old castings and sheets, 9.75-10.25; clean borings and turnings, 6.25-6.75; segregated low copper clips, 13.00-13.50; segregated high copper clips, 13.00-13.50; mixed low copper clips, 12.00-12.50; mixed high copper clips, 10.75-11.25.

(Cents per pound, Chicago)

Aluminum: Old castings and sheets, 11.00-11.50; clean borings and turnings, 9.00-9.50; segregated low copper clips, 16.00-16.50; segregated high copper clips, 15.00-15.50; mixed low copper clips, 15.00-15.50; mixed high copper clips, 14.50-15.00.

(Cents per pound, Cleveland)

Aluminum: Old castings and sheets, 10.00-10.50; clean borings and turnings, 9.00-9.50; segregated low copper clips, 14.00-14.50; segregated high copper clips, 12.50-13.00; mixed low copper clips, 13.00-13.50; mixed high copper clips, 12.00-12.50.

REFINERS' BUYING PRICES

(Cents per pound, carlots, delivered refinery)

Beryllium Copper: Heavy scrap, 0.020-in. and heavier, not less than 1.5% Be, 55.00; light scrap, 50.00; turnings and borings, 35.00.

Copper and Brass: No. 1 heavy copper and wire, 24.50; No. 2 heavy copper and wire, 23.00; light copper, 20.75; refinery brass (60% copper) per dry copper content, 22.00.

INGOTMAKERS' BUYING PRICES

Copper and Brass: No. 1 heavy copper and wire, 24.50; No. 2 heavy copper and wire, 23.00; light copper, 20.75; No. 1 composition borings, 18.50; No. 1 composition solids, 19.00; heavy yellow brass solids, 13.00; yellow brass turnings, 12.00; radiators 14.50.

PLATING MATERIALS

(F.o.b. shipping point, freight allowed on quantities)

ANODES

Cadmium: Special or patented shapes, $1.45.
Copper: Flat-rolled, 46.79; oval, 45.00; 5000-10,000 lb; electrodeposited, 38.50, 2000-5000 lb lots; cast, 41.00. 5000-10,000 lb quantities.

Nickel: Depolarized, less than 100 lb, 114.25; 100-499 lb, 112.00; 500-4999 lb, 107.50; 5000-29,999 lb, 105.25; 30,000 lb, 103.00. Carbonized, deduct 3 cents a lb.

Tin: Bar or slab, less than 200 lb, 117.50; 200-499 lb, 116.00; 500-999 lb, 115.50; 1000 lb or more, 115.00.

Zinc: Balls, 18.00; flat tops, 18.00; flats, 20.75; ovals, 20.00, ton lots.

CHEMICALS

Cadmium Oxide: $1.45 per lb in 100-lb drums.

Chromic Acid (flake): 100-2000 lb, 31.00; 2000-10,000 lb, 30.50; 10,000-20,000 lb, 30.00; 20,000 lb or more, 29.50.

Copper Cyanide: 100-200 lb, 65.90; 300-900 lb, 63.00; 1000-19,900 lb, 61.90.

Copper Sulphate: 100-1900 lb, 14.65; 2000-5900 lb, 12.65; 6000-11,900 lb, 12.40; 12,000-22,900 lb, 12.15; 23,000 lb or more, 11.65.

Nickel Chloride: 100 lb, 45.00; 200 lb, 43.00; 300 lb, 42.00; 400-4900 lb, 40.00; 5000-9900 lb, 38.00; 10,000 lb or more, 37.00.

Nickel Sulphate: 5000-22,999 lb, 29.00; 23,000-39,990 lb, 28.50; 40,000 lb or more, 28.00.

Sodium Cyanide (Cyanobrik): 200 lb, 20.80; 400-800 lb, 19.80; 1000-19,800 lb, 18.80; 20,000 lb or more, 17.80.

Sodium Stannate: Less than 100 lb, 78.00; 100-600 lb, 68.80; 700-1900 lb, 66.00; 2000-9900 lb, 64.10; 10,000 lb or more, 62.80.

Stannous Chloride (anhydrous): 25 lb, 153.20; 100 lb, 148.30; 400 lb, 145.90; 800-19,900 lb, 105.00; 20,000 lb or more, 98.90.

Stannous Sulphate: Less than 50 lb, 138.40; 50 lb, 108.40; 100-1900 lb, 106.40; 2000 lb or more, 104.40.

Zinc Cyanide: 100-200 lb, 59.00; 300-900 lb, 57.00.

(*Concluded from Page* 459)

ment in demand this year, says Edwin C. Barringer, executive vice president, Institute of Scrap Iron & Steel Inc.

Last year was the poorest for the scrap industry since 1946, despite a shortlived pickup in the early fall.

About 22 million gross tons of purchased scrap were consumed by domestic steel mills and foundries in 1958, vs. 29.6 million in 1957. Exports amounted to only 2.6 million tons, vs. 5.9 million during 1957, when an all-time high was registered.

Last year, the steel mills and foundries generated and remelted about 28 million tons of home scrap, vs. 36 million in 1957.

Total home scrap, plus purchased scrap, came to about 50 million tons, vs. about 66 million in 1957, a drop of 24 per cent.

The decline in use of pig iron during 1958 was about the same as that in scrap. So the percentages of scrap and pig iron charged into furnaces were roughly equal. In 1957, the scrap charge was 48.7 per cent and pig iron 51.3 per cent.

Use of home scrap increased during the year at the expense of purchased material. And improved technology operated against purchased scrap. Steel producers were less dependent on purchases to support furnace melts.

Pricewise, 1958 was a recession year for scrap. Average prices were lower, and the spread between heavy melting steel and No. 2 bundles increased greatly. Except for 1954, last year was the lowest price year since 1950.

Structural Shapes . . .

Structural Shape Prices, Page 448

November bookings of fabricated structural steel were 242,635 tons, 7 per cent less than in the previous month, but 8000 tons greater than the average monthly tonnage in the first 11 months of the year, reports the American Institute of Steel Construction.

New orders in November marked the sixth successive month that bookings exceeded the comparable tonnage the year before.

Shipments in November were 271,000 tons, a 12 per cent drop from October. Total shipments in the first 11 months of the year were 3,397,647 tons, 12 per cent down from the like 1957 period.

The order backlog as of Nov. 30 was 1,838,860 tons. Of this total, 1,050,825 tons are scheduled for fabrication during the four months ending Mar. 31.

STRUCTURAL SHAPES . . .

STRUCTURAL STEEL PLACED

1530 tons, two seven-span rolled beam and welded girder bridges, Route 8, Thomaston-Litchfield-Harwinton, Conn., to Elizabeth Iron Works Inc., Elizabeth, N. J.; W. J. Megin Inc., Naugatuck, Conn., contractor.

1400 tons, building, United States mission to the United Nations, New York, to the Lafayette Iron Works, Jersey City, N. J.

1200 tons, trash racks, powerplant, Tuscarora, N. Y., awarded by the New York Power Authority to Kaustine Furnace & Tank Corp.

1060 tons, state bridgework, Rochester, N. Y., through the Grow Construction Co., New York, to the American Bridge Div., U. S. Steel Corp., Pittsburgh.

1000 tons, manufacturing building, Metro Glass Co., Carteret, N. J., to the Oltmer Iron Works, Jersey City, N. J.

730 tons, steel beams, naval shipyard, Bremerton, Wash., to Isaacson Iron Works, Seattle, $220,306.

715 tons, state bridgework, Ulster County, New York, through John Arborio Inc., general contractor, to the Harris Structural Steel Co., New York.

640 tons, Prospect Park observation tower, Niagara Falls, N. Y., to White Plains Iron Works, Peekskill, N. Y.

460 tons, state bridgework, Glen Cove, L. I., N. Y., to Bethlehem Steel Co., Bethlehem, Pa.

400 tons, motel, Tenth Avenue, between 49th and 50th Streets, Manhattan, New York, through Diesel Construction Co. to Simon Holland & Son Inc., Brooklyn, N. Y.

345 tons, baghouse and main flue, Laurel Hill plant (Long Island City, N. Y.), Phelps Dodge Mining Corp., New York, to Mineola Steel Fabricators, Mineola, Long Island, N. Y.

300 tons, structurals and bars, two state highway bridges, Manchester, N. H., to Groisser & Shlager Iron Works, Somerville, Mass. (structurals), and Joseph T. Ryerson & Son Inc., Boston (reinforcing bars); Coleman Bros., Readville, Mass., general contractor.

STRUCTURAL STEEL PENDING

1250 tons, seven-span welded girder bridge, Bedford-Manchester, N. H.; also 430 tons of reinforcing bars and 230 tons of steel piles.

475 tons, state highway bridge, Fall River, Mass., Campanella & Cardi Construction Co., Hillsgrove, R. I., low on general contract.

350 tons, state bridges, including a three-span continuous beam bridge, Hopkinton, N. H.; bids Jan. 5 at Concord, N. H.

230 tons, two-span welded girder bridge, Middletown, Conn., bids Jan. 5 at Hartford,